FX-850/1050

TECHNICAL MANUAL

EPSON

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PREFACE

This manual describes functions, theory of electrical and mechanical operations, maintenance, and repair of the FX-850 and FX- 1050.
The instructions and procedures included herein are intended for the experienced repair technician, and attention should be given to the precautions on the preceding page. The chapters are organized as follows:

Chapter 1 - Provides a general product overview, lists specifications, and illustrates the main components of the printer.

Chapter 2 - Describes the theory of printer operation.

Chapter 3 - Discusses the options

Chapter 4 - Includes a step-by-step guide for product disassembly, assembly, and adjustment.

Chapter 5 - Provides Epson-approved techniques for troubleshooting.

Chapter 6 - Describes preventive maintenance techniques and lists lubricants and adhesives required to service the equipment.

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REVISION TABLE

REVISION	DATE ISSUED	CHANGE DOCUMENT
A	February 15, 1988	1st issue

PRECAUTIONS

Precautionary notations throughout the text are categorized relative to 1) personal injury, and 2) damage to equipment:

DANGER **Signals a precaution which, if ignored, could result in serious or fatal personal injury. Great caution should be exercised in performing procedures preceded by a DANGER headings.**

WARNING **Signals a precaution which, if ignored, could result in damage to equipment.**

The precautionary measures itemized below should always be observed when performing repair/maintenance procedures.

DANGER

1. **ALWAYS DISCONNECT THE PRODUCT FROM BOTH THE POWER SOURCE AND THE HOST COMPUTER BEFORE PERFORMING ANY MAINTENANCE OR REPAIR PROCEDURE.**
2. **NO WORK SHOULD BE PERFORMED ON THE UNIT BY PERSONS UNFAMILIAR WITH BASIC SAFETY MEASURES AS DICTATED FOR ALL ELECTRONICS TECHNICIANS IN THEIR LINE OF WORK.**
3. **WHEN PERFORMING TESTING AS DICTATED WITHIN THIS MANUAL, DO NOT CONNECT THE UNIT TO A POWER SOURCE UNTIL INSTRUCTED TO DO SO. WHEN THE POWER SUPPLY CABLE MUST BE CONNECTED, USE EXTREME CAUTION IN WORKING ON POWER SUPPLY AND OTHER ELECTRONIC COMPONENTS.**

WARNING

1. **REPAIRS ON EPSON PRODUCT SHOULD BE PERFORMED ONLY BY AN EPSON CERTIFIED REPAIR TECHNICIAN.**
2. **MAKE CERTAIN THAT THE SOURCE VOLTAGE IS THE SAME AS THE RATED VOLTAGE, LISTED ON THE SERIAL NUMBER/RATING PLATE. IF THE EPSON PRODUCT HAS A PRIMARY-AC RATING DIFFERENT FROM THE AVAILABLE POWER SOURCE, DO NOT CONNECT IT TO THE POWER SOURCE.**
3. **ALWAYS VERIFY THAT THE EPSON PRODUCT HAS BEEN DISCONNECTED FROM THE POWER SOURCE BEFORE REMOVING OR REPLACING PRINTED CIRCUIT BOARDS AND/OR INDIVIDUAL CHIPS.**
4. **IN ORDER TO PROTECT SENSITIVE μP CHIPS AND CIRCUITRY, USE STATIC DISCHARGE EQUIPMENT, SUCH AS ANTI-STATIC WRIST STRAPS, WHEN ACCESSING INTERNAL COMPONENTS.**
5. **REPLACE MALFUNCTIONING COMPONENTS ONLY WITH THOSE COMPONENTS RECOMMENDED BY THE MANUFACTURER; INTRODUCTION OF SECOND-SOURCE ICS OR OTHER NONAPPROVED COMPONENTS MAY DAMAGE THE PRODUCT AND VOID ANY APPLICABLE EPSON WARRANTY.**

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CHAPTER 1
GENERAL DESCRIPTION

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1.1 FEATURES

The FX-850 and FX-1 050 are serial dot matrix 9-pin terminal printers that print at a maximum of 264 CPS. Either model FX-850 with 80 columns or FX-1 050 with 136 columns can be selected according to your requirements. The main features are as follows:

- Max. printing speed: 264 CPS (Draft and Elite)
  220 CPS (Draft and Pica)
- Advanced paper handling functions: Auto tear-off
  Auto loading
  Auto back-out
  Micro adjustment
- SelecType function (Any print mode can be selected directly from the front panel). Once a mode is selected, it is stored in the non-volatile memory, and is selected when the printer power is turned on.
- Two NLQ fonts (Roman and Saris-serif) are standard.
- Printer driver EPSON ESC/P-83 is standard. (This driver is compatible with the high class models such as FX-800, -1000, -86e, and -286e.)
- Double-height function
- Pitch control is possible in the NLQ mode. (Pica, elite, proportional modes)
- Since the IBM emulation mode is standard, these printers are IBM-compatible. The IBM characters are also standard.
- 8K-byte input data buffer (Buffering can be disabled.)
- Push tractor unit
- Printing is possible on envelopes and labels in addition to fan-fold paper, cut sheets, and roll paper.
- User-defined characters are supported in both the Draft and NLQ (Saris-serif) modes. Once a character is registered, it is stored in the non-volatile memory and need not be re-registered. The user-defined character set can only be selected (as a default character set) using the DIP switches.
- Compatible with EPSON optional interface board series #81 XX.

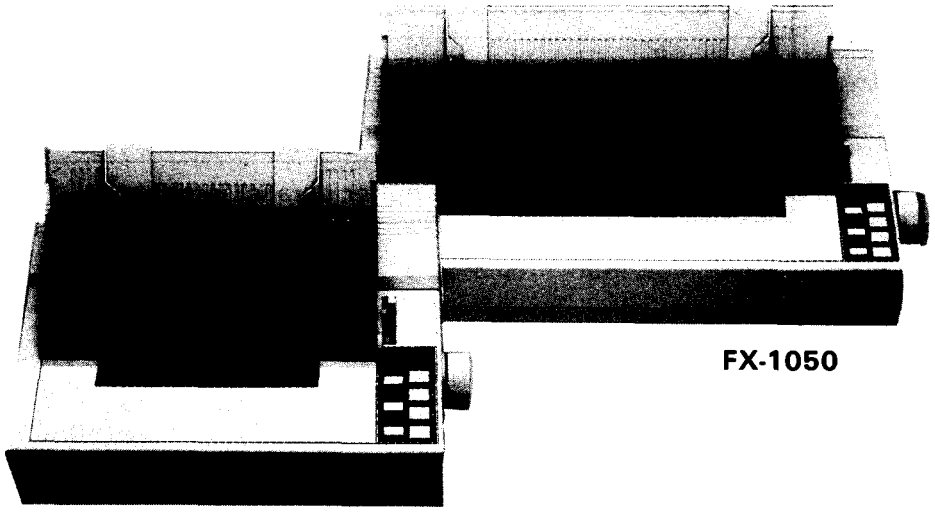


Figure 1-1. Exterior Views of the FX-850/1050

Table 1-1. Optional Units

No.	Name	FX-850	FX-1 050
#83 10	Roll Paper Holder	o	
#731 1	Pull Tractor Unit	o	
#731 2	Pull Tractor Unit		o
#7339	Cut Sheet Feeder (single-bin)	o	
#7340	Cut Sheet Feeder (single-bin)		o
#8750	Ribbon Cartridge	o	
#8755 (M)	Ribbon Cartridge		o
#8758	Ribbon Pack	o	
#81 XX	Optional Interface Board	o	

Table 1-2. Optional Interface Boards

No.	Name
#8 143	New serial interface
#8145	RS-232C current loop interface type II
#8 148	Intelligent serial interface
#8 149	Intelligent serial interface type II
#8 149M	Intelligent serial interface type III
#816 1	IEEE-488 interface
#8 165	Intelligent IEEE-488 interface
#8172	32 K-byte buffer parallel interface
#81 72M	128K-byte buffer parallel interface

1.2 SPECIFICATIONS

The FX-850/1 050 communicates with a wide variety of host computers. This section describes the specifications for the printer.

1.2.1 Hardware Specifications

Printing Method	Serial, impact dot matrix
Pin Configuration	See Figure 1-2 (diameter: 0.29 mm).

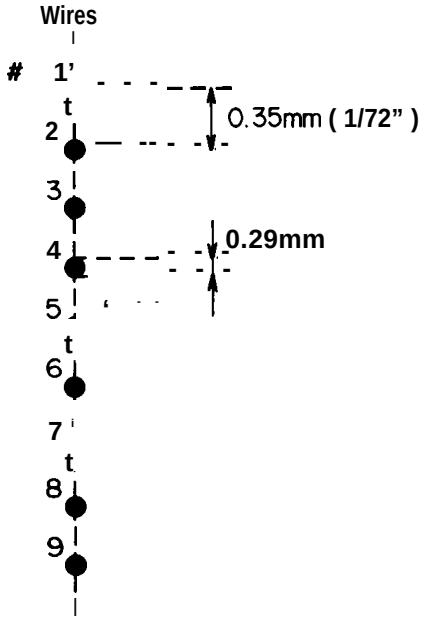


Figure 1-2. Printhead Pin Configuration

Feeding Method	Friction feed Tractor feed (push: standard, pull: optional)

NOTES: 1. When using friction feed:
- Use the paper tension unit.
- Do not use fanfold paper.
- Do not perform reverse feed beyond than 1/6 inches after the paper end has been detected.
- Do not use multi-part, single-sheet forms.

2. When using tractor feed:
- Release the friction feed mechanism.
- Multiple copies for printing must be finished by pasting them together at the line or dots.
- Copy paper must be a carbonless multi-part paper.

a) When using push tractor feed:
- Use the paper tension unit.

- Do not perform reverse feeding for more than 1/6 inches.
- Because accuracy of paper feed cannot be assured, do not perform reverse feeding after the paper end has been detected.

b) When using pull tractor feed:

- Remove the paper tension unit and mount the pull tractor unit.
- Use the paper path when a single sheet is inserted.

c) When using push-pull tractor feed:

- Remove the paper tension unit and mount the pull tractor unit.
- Do not loosen the paper between the platen and the pull sprocket.
- -Precisely the horizontal position of the pull sprocket and push tractor.
- Do not perform reverse feeding after the paper end has been detected.

Paper Loading Directions

Fanfold paper	Inserted from the rear side
Cut sheet paper	Inserted from the up side

Line Spacing 1/6" or programmable (min. 1/2 16")

Line Feed Speed See Table 1-3.

Table 1-3. Line Feed Speeds

Type of Paper	Continuous Feed	Intermittent Feed	Feed Speed
Cut Sheet	48 ins/line	71 ins/line	3.5 "/see
Fanfold	53 ins/line	76 ins/line	3.1 "/see

Paper Specifications

Cut sheet paper Refer to Table 1-4.

Table 1-4. Cut Sheet Paper Specified Conditions

	FX-850	FX-1 050
Width [mm]	182-257 (7.2 - 10.1")	182-366 (7.2 - 14.4")
Length [mm]	182 - 364 (7.2 - 14.3")	
Thickness [mm]	0.065 - 0.10 (0.0025 - 0.004")	
Weight [Kg]	45 - 70 (14 - 22 lb)	
Quality	Plain paper	
Copies	Not available	

NOTE: The form overriding mechanism enables printing as close as 13.5 mm from the bottom edge of the paper. However, paper feed accuracy is not guaranteed within about 22 mm from the bottom.

Fanfold Refer to Table 1-5.

Table 1-5. Fanfold Paper Specified Conditions

	FX-850	FX-1 050
Width [mm]	101 - 254 (4.0 - 10.0")	101 - 406 (4.0 - 16.0")
Copies [sheet]	4 (1 original + 3) at normal temperature 3 (1 original + 2) at all temperature range	
Quality	Plain paper	
Total Thickness [mm]	0.065 - 0.32 (0.0025 -0.01 2")	
Weight [Kg]	Fanfold 45-70 (14 -22 lb) Multi-part forms 34 - 50 X N (N ≦ 4)	

Roll paper Refer to Table 1-6.

Table 1-6. Roll Paper Specifications

	FX-850 only
Width [mm]	216 ± 3
Length [mm]	Roll diameter not more than 127 mm (5")
Thickness [mm]	0.07 -0.09 (0.0028 - 0.0035")
Weight [Kg]	45 - 55
Quality	Plain paper
Copies	Not available

Envelope Refer to Table 1-7.

Table 1-7. Envelope Specifications

	FX-850/1 050
Size [mm]	166 X 92, 240 X 104
Weight [Kg]	3 9 - 78 (12 -24 lb)
Quality	Plain, Bond, Air mail

Operating conditions:

Printing must be executed at normal room temperature.

Envelopes must be oriented with the long direction parallel to the carriage.

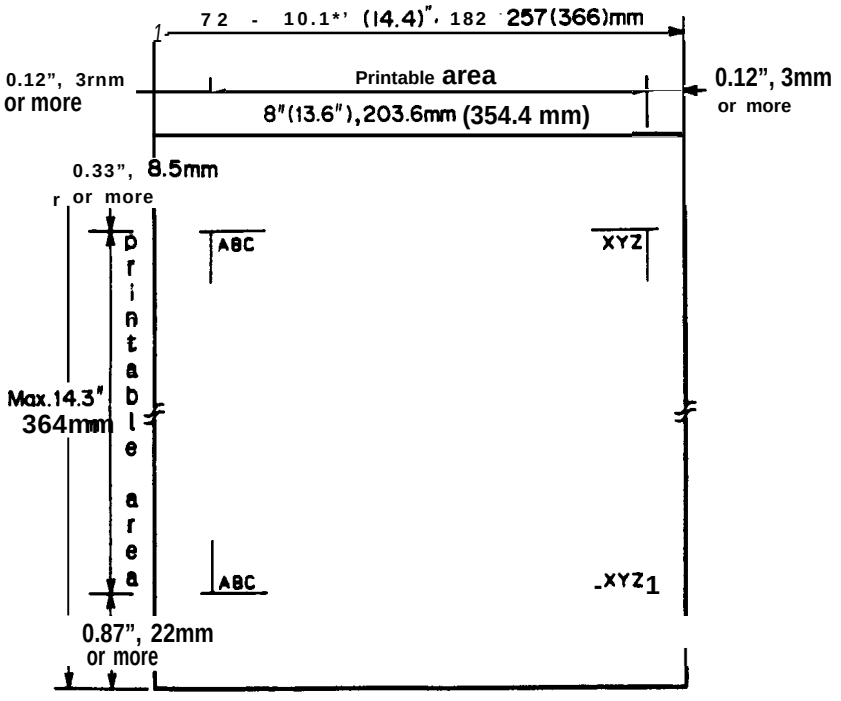
Label **Refer to Table 1-8.**

Table 1-8. Label Specifications

	FX-850/1 050
Size [mm]	63.5 X 2.38 (2.5 X 15/16"), 101.6 X 2.38 (4 X 15/1 6") 101.6 X 36.5 (4 X 1 7/1 6")
Thickness [mm]	less than 0.19 (0.0075")

Printable Area

Cut sheet paper **See Figure 1-3.**

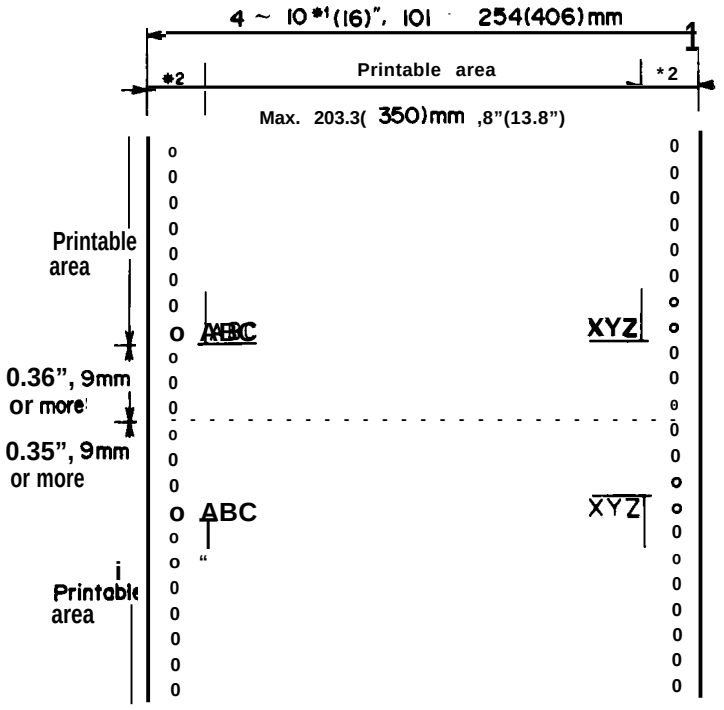


NOTES: 1. Values in the parentheses apply to the FX-105O.

2. Printing is possible for approximately 42 mm after the bottom edge of a page has been detected. Thus, the value 13.5 mm (lowest print position) is given for reference only. Paper feed accuracy cannot be assured in the area approximately 22 mm (0.87") from the bottom edge of the page.

Figure 1-3. Cut Sheet Paper Printable Area

Fanfold paper See Figure 1-4.



NOTE: 1. Values in the parentheses apply to FX-105O.
2. 0.47", 12 mm or more when the 101 to 242 mm (4 to 9.5") width paper is used.
0.98", 25 mm or more when the 254 mm (10") width paper is used.

Figure 1-4. Fanfold Paper Printable Area

Envelopes

Size	**No. 6 (166 X 92 mm), No. 10 (240 X 104 mm)**
Quality	**Bond paper, xerographic copier paper, airmail paper**
Thickness	**0.16- 0.52 mm (0.0063 -0.01 97")**

NOTE: Differences in thickness within printing area must be less than 0.25 mm (0.0098").

Weight 121 -241 lb (45 -91 g/m²)

NOTES: 1. Envelope printing is only available at normal temperature.
2. Keep the longer side of the envelope horizontally at setting.
3. Set the left of No. 6 envelope at the setting mark of the sheet guide.

Label

Size	**2 1/2 X 15/16", 4 X 15/16", 4 X 1 7/16"**
Thickness	**O.19 mm (0.0075) max.**

NOTE: Thickness excluding the base paper must be less than or equal to 0.12 mm (0.0075").

NOTES: 1. Printing of labels is only available at normal temperature.
2. Labels must be fanfold.
3. Labels with pressure-sensitive paper must be jointed by pasting along the dots or lines, and the total thickness must be less than or equal to 0.3 mm (O. 118“) to be printed out under conditions that must be between 5 to 35 “C and 20 to 80% RH.
4. Examples of labels: AVERY CONTINUOUS FORM LABELS
AVERY MINI-LINE LABELS

Lever Adjustment See Figure 1-5 and Table 1-9.

Table 1-9. Lever Adjustment

Lever Position	Paper Thickness [mm]
2nd	0.06 - 0.12
3rd	o.13 - 0.17
4th	0.18 ~ 0.25
5th	0.26 ~ 0.32

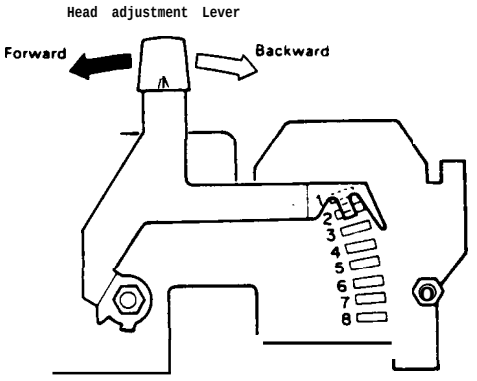


Figure 1-5. Head Adjustment Lever Positioning

NOTES: 1. When printing density becomes lighter, set the head adjustment lever one position lower.
2. When using thicker paper than shown in the above table, set the head adjustment lever to the 6th or higher appropriate position by performing the self-test operation.

Ribbon Cartridge See Table 1-10.

Table 1-10. Ribbon Cartridge Specification

Ribbon Model No.	#8750	#8755 (M)
Printer	FX-850	FX-1 050
Color	Black	
Life [characters]	3 million (14 dots/character)	
Dimension [mm] (W) X (h) X (d)	293 X 34 X 72	468 X 34 X 78

Dimensions See Table 1-11 (Details are shown in Figures A-45 and 46.).
Weight See Table 1-11.

Table 1-11. Dimensions and Weight

	Width [mm]	Height [mm]	Depth [mm]	Weight [Kg]
FX-850	430	150	360	9.5
FX-I 050	605	150	360	12.5

NOTE: Excluding platen knob and paper guide.

Electrical Specifications See Table 1-12.

Table 1-12. Electrical Specifications

	120 V Version	220/240 V Version
Voltage [V AC]	120V ± 10YO	220/240V ± 10%
Frequency range [Hz]	49.5 - 60.5	
Rating current [A]	2	1
Insulation resistance [M ohm] min. (between AC line and chassis)	10	
Dielectric strength [V AC, rms] (1 minute, between AC line and chassis)	1250	1250

Environmental Conditions Refer to Table 1-13.

Table 1-13. Environmental Conditions

	Storage	Operating
Temperature ["C]	–30 - 60	5 -35
Humidity [% RH]	5 - 85	10 - 80
Resistance to shock [G] (within 1 ms)	2	1
Resistance to vibration [G] (55 Hz, max.)	0.50	0.25

Reliability

MCBF 5 million lines (excluding printhead)
(MCBF... Mean Cycles Between Failure)
MTBF FX-850: 4000 POH (duty 25%)
FX-105O: 6000 POH (duty 25%)
Printhead life 100 million characters (14 dots/character)

Safety Approvals

Safety standards	UL4785th (U.S.A. version)
	CSA22.2#220
	VDE0806(TUV) (European version)
Radio Frequency (RFI) Interference	FCC class B (U.S.A. version)
	VDE871 (European version)

1.2.2 Firmware Specifications

Control Code	ESC/P-83
Printing Direction	
Text	Bidirectional printing with logic seeking
Bit-image	Unidirectional printing
Character Code	8 bits
Character Set	96 ASCII and 13 international character sets
	Graphics
Font	NLQ Roman: 10, 12, 15, Proportional
	NLQ Saris-serif: 10, 12, 15, Proportional
	Draft: 10, 12, 15, Proportional
Printing Mode	Printing quality (Draft/NLQ)
	Character pitch (10, 12, 15 CPI or Proportional)
	Condensed
	Double-width
	Double-height
	Emphasized
	Double-strike
	Italic
	Underlined

NOTE: A condensed mode for 15 CPI characters is not available.

Print Speed — Refer to Table 1-14.

Table 1-14. Print Speed

Type of Letters	Print Speed [cps]
Draft pica	220 (107)
Draft elite	264 (1 28)
Condensed draft pica	183 (91)
Emphasized draft pica	107
NLQ normal pica	45

NOTE: When any italic character is in the same line, the print speed will be reduced to the value in the parentheses.

Print Columns Refer to Table 1-15.

Table 1-15. Print Columns

Type of Letters	Printable Columns [*cpl*]	
	FX-850	FX-1 050
Normal	80	136
Condensed	137	233
Elite	96	163
Condensed elite	160	272

NOTE: In Condensed mode, printable column is always 137. (Previous FX series is 132.)

Character Size, Pitch Refer to Table 1-16.

Table 1-16. Character Size and Pitch

Type of Letters	Width [mm]	Height [mm]	Character Pitch [mm]
Normal	2.1	3.1	2.54 (1 O cpi)
Emphasized	2.1	3.1	2.54 (1 O cpi)
Condensed	1.05	3.1	1.48 (17 cpi)
Elite	1.7	3.1	2.11 (12 cpi)
Condensed elite	0.85	3.1	1.27 (20 cpi)

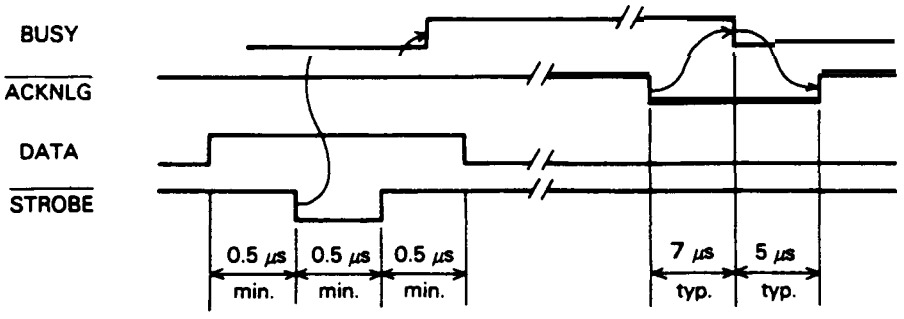
NOTE: Width of Elite character is changed to 1.7 mm from 2.1 mm (not same as normal mode).

1.3 INTERFACE OVERVIEW

The FX-850/1 050 has 8-bit parallel interface as standard.

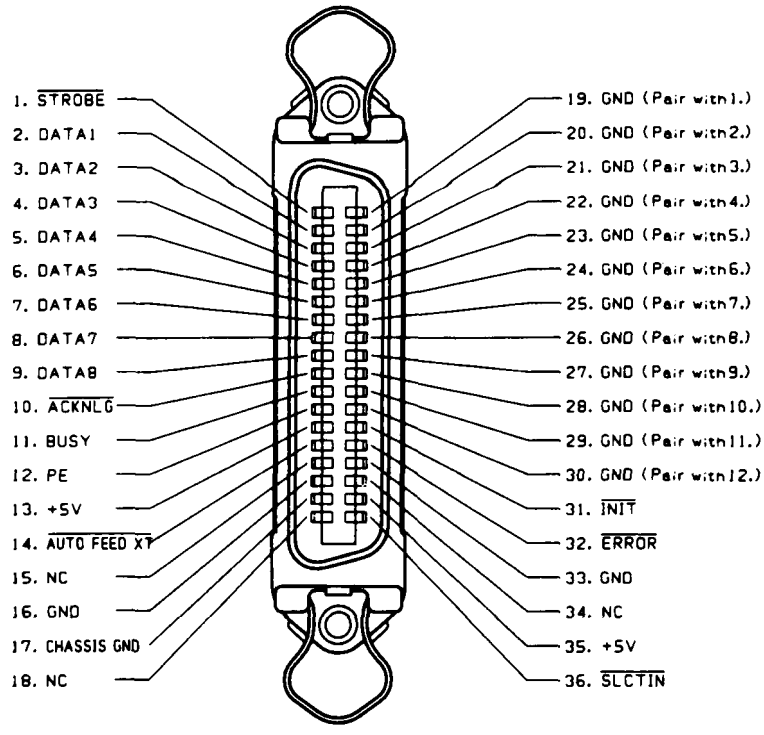
1.3.1 8-bit Parallel Interface Specifications

Data Transmission Mode	8-bit pallarel
Synchronization	By $\overline{\text{STROBE}}$ pulse
Handshaking	By BUSY and $\overline{\text{ACKNLG}}$ (either or both)
Logic Level	TTL compatible
Data Transmission Timing	See Figure 1-6.
Connector	57-30360 (AMPHENOL) or equivalent (See Figure 1-7.)



NOTE: Transmission time (rising and falling time) of every input signal must be less than 0.2 μs.

Figure 1-6. Data Transmission Timing of 8-bit Parallel Interface



⊏igure 1-7. 36-Pin 57-30360 Connector

Table 1-17 shows the connector pin assignments and signal functions of the 8-bit parallel interface.

Table 1-17. Connector Pin Assignments and Signal Function

Pin No.	Signal Name	Return Pin No.	DIR	Functional Description
1	$\overline{\text{STRORE}}$	19	In	**Strobe pulse to read the input data.** Pulse width must be more than 0.5μs. Input data is latched after falling edge of this signal.
2	DATA 1	20	In	These signals represent information of the 1st to 8th bits of parallel data, respectively. Each signal is at "HIGH" level when data is logical "1" and "LOW" when logical "O".
3	DATA 2	21	In	
4	DATA 3	22	In	
5	DATA 4	23	In	
6	DATA 5	24	In	
7	DATA 6	25	In	
8	DATA 7	26	In	
9	DATA 8	27	In	
10	$\overline{\text{ACKNLG}}$	28	out	This pulse indicates data has been received and the printer is ready to accept more data. Pulse width is approximately 12μs.
11	BUSY	29	out	**A "HIGH" signal indicates that the printer cannot receive data.** The signal becomes "HIGH" in the following cases: 1. During data entry 2. During printing operation 3. In off-line status 4. During printer error status
12	PE	30	out	A "HIGH" signal indicates that the printer is out of paper.
13				Pulled up to +5V through 3.3 K ohms resistor.
14	$\overline{\text{AUTO FEED XT}}$		In	With this signal at "LOW"' level, the paper is automatically fed one line after printing. (The signal level can be fixed to "LOW"' with DIP SW 2-4.)
15	NC			Not used.
16	0V			Logic GND level.
17	CHASSIS GND			Printer chassis GND. In the printer, the chassis GND and the logic GND are isolated from each other.
18	NC			Not used.
19 - 30	GND			TWISTED-PAIR RETURN signal GND level.
31	INIT		In	When the level of this signal become "LOW", the printer controller is reset to its initial state and the print buffer is cleared. This signal is normally at "HIGH" level, and its pulse width must be more than 50 μs at the receiving terminal.
32	$\overline{\text{ERROR}}$		out	The level of this signal becomes "LOW" when the printer is in - 1. Paper-out status 2. Off-line status 3. Error status

Table 1-17. Connector Pin Assignments and Signal Function (cent'd)

Pin No.	Signal Name	Return Pin No.	DIR	Functional Description
33	GND			Same as with Pin No. 19 to 30.
34	NC			Not used.
35				Pulled up to +5V through 3.3 K ohms resistor.
36	$\overline{\text{SLCT-IN}}$		In	The DC 1/DC3 code is only valid when this signal is "HIGH" level. (Internal fixing can be carried out with Jumper- I.)

NOTES:
1. "DIR" refers to the direction of signal flow as viewed from the printer.
2. "Return" denotes "TWISTED-PAIR RETURN" and is to be connected at signal ground level. As to the wiring for the interface, be sure to use a twisted-pair cable for each signal and never fail to complete connection on the Return side. To prevent noise effectively, these cables should be shielded an connected to the chassis of the host computer and the printer, respectively.
3. All interface conditions are based on TTL level. Both the rise and fall times of each signal must be less than 0.2μs.
4. Data transfer must not be carried out by ignoring the $\overline{\text{ACKNLG}}$ or BUSY signal.
   (Data transfer to this printer can be carried out only after confirming the $\overline{\text{ACKNLG}}$ signal or when the level of the BUSY signal is "LOW".)

Table 1-18 shows the printer select/deselect (DC 1/DC3) control, including relations among ON-LINE, $\overline{\text{SLCT-IN}}$ input, DC 1/DC3, and interface signals.

Table 1-18. Printer Select/Deselect Control

ON-LINE SW	$\overline{\text{SLCT-IN}}$	DC1/DC3	$\overline{\text{ERROR}}$	BUSY	$\overline{\text{ACKNLG}}$	DATA ENTRY
OFF-LINE	HIGH/LOW	DC 1/DC3	LOW	HIGH	No pulse	Disable
ON-LINE	HIGH	DC 1	HIGH	LOW/HIGH (During data entry)	Pulse output after entry	Enable (Normal Process)
		DC3	HIGH	LOW/HIGH (During data entry)	Pulse output after entry	Enable (Waits DC1. See Note 2)
	L O W	DC 1	HIGH	LOW/HIGH (During data entry)	Pulse output after entry	Enable (Normal Process)
		DC3	HIGH	LOW/HIGH (During data entry)	Pulse output after entry	

NOTES: 1. In the Table 1-18, it is assumed that no $\overline{\text{ERROR}}$ status exists other than that attributable to OFF-LINE mode.

2. Once the printer is deselected by the DC3 code, the printer will not revert the selected state unless the DC 1 code is input again. (In the deselected state, the printer ignores input data until the DC 1 code is received.)
3. The DC 1 and DC3 codes are enabled only when the $\overline{\text{SLCT-IN}}$ signal (Input Connector No.36 for the parallel interface unit) is HIGH and printer power is initialized.
4. If the $\overline{\text{SLCT-IN}}$ signal is LOW when the printer is initialized, DC 1/DC3 printer select/deselect control is invalidated, and these control codes are ignored.
5. If the $\overline{\text{SLCT-IN}}$ signal is HIGH and is not set to LOW by jumper 6 when printer initialized, the printer starts from the selected (DC 1) state.

1.4 DIP SWITCHES AND JUMPER SETTINGS

This section describes the DIP switch selections and jumper setting for the FX-850/1 050 printer.

1.4.1 DIP Switch Settings

The DIP switches are located at the right side of the printer. When the printer hardware is initialized, the following functions are set to the default values shown in the table below.

Table 1-19. DIP Switch 1 Settings

SW	Description	ON	OFF
1-1	Default character set	User-defined	ROM
1-2	Shape of zero	Slashed	Not slashed
1-3	Table select	Graphic	Italic
1-4	Protocol mode	IBM emulation	ES C/P
1-5	Short tear-off mode	off	On
1-6	International character set	See Table 1-20.	
1-7			
1-8			

NOTE: When DIP SW1-4 is on (IBM mode), the function of DIP SW1-3 changes to auto CR ON/OFF.

Default character set

When DIP switch 1-1 is ON, the user-defined character set will be selected as default. User-defined characters are maintained in printer memory even when the power is turned off, so the user-defined character set can be easily selected simply by turning off the power, setting this switch to ON, and then turning the power on again.

Shape of zero

When DIP switch 1-2 is ON, prints a stashed zero (0); when OFF, prints open zeros (0). Useful for clearly distinguishing between uppercase O and zero when printing program lists, etc.

Protocol mode

When DIP switch 1-4 is ON, printer operates in the IBM emulation mode; when off, printer operates in the Epson ESC/P mode.

Functions of DIP switches 1-6, 1-7, and 1-8 are different when using the printer in the IBM emulation mode.

Short Tear-off

When print operation has finished, the short tear-off feature automatically feeds the perforation of the continuous paper to the tear-off edge of the sheet guide cover so that the user can tear off the last sheet. When the user resume printing, the paper is fed backward to the loading position.

Table 1-20. International Character Set

Country	SW 1-6	SW 1-7	SW 1-8	IBM CG Table
USA	ON	ON	ON	CG Table 1
France	ON	ON	OFF	CG Table 2
Germany	ON	OFF	ON	
UK	ON	OFF	OFF	
Denmark	OFF	ON	ON	
Sweden	OFF	ON	OFF	
Italy	OFF	OFF	ON	
Spain	OFF	OFF	OFF	

NOTE: When DIP SW1-4 is on (IBM mode), the functions of DIP SW1-6 through SW1-8 change to IBM character generator selection.

Table 1-21. DIP Switch 2 Settings

SW	Description	ON	OFF
2-1	Page length	12 inch	11 inch
2-2	Cut sheet feeder mode	On	off
2-3	1 -inch skip over perforation	On	off
2-4	Auto line feed	On	off

1.4.2 Jumper Setting

The jumper J 1 is located on the main board and it can fix the $\overline{\text{SLCT-IN}}$ signal to "LOW" level.

Table 1-22. J1 Setting

ON	Fix to "LOW"
OFF	Depend on the external signal.

NOTE: If the jumper J 1 is connected, the $\overline{\text{SLCT-IN}}$ signal is fixed to LOW, and DC 1 /DC3 printer select control is ignored.

1.5 SELF TEST OPERATION

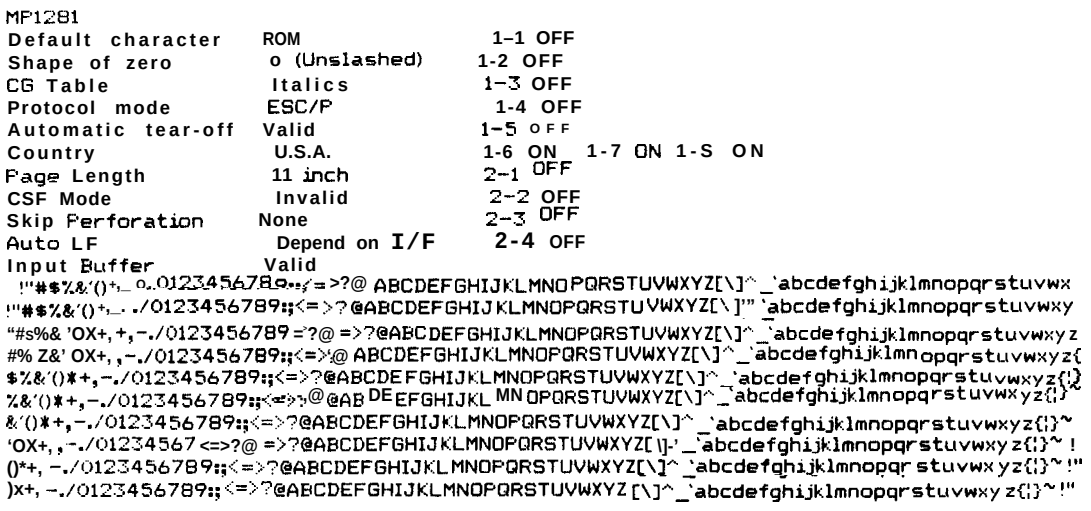
The FX-850/1050 printer has the following self test (self printing) function which checks the following:

- **Control Circuit Functions**
- **Printer Mechanism Functions**
- **Print Quality**
- **DIP Switch Settings**

Table 1-23 lists the self test operating instructions and Figure 1-8 shows the self test printing.

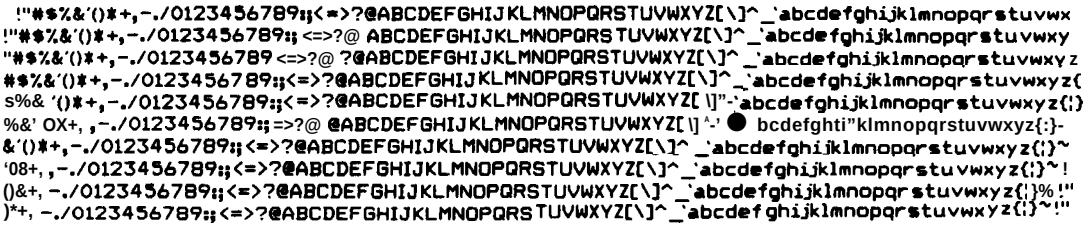
Table 1-23. Self Test Operation

Type-face	Start	stop
Draft	Turn the power ON while pressing the LINE FEED switch.	● Paper out condition. ● Press the ON-LINE switch, and turn the power OFF.
NLQ	Turn the power ON while pressing the FORM FEED switch.	



Draft Mode

NLQ (Roman) Mode



NLQ (Saris-Serif) Mode

Figure 1-8. Self Test Printing

1.6 HEXADECIMAL DUMP FUNCTION

The hexadecimal dump function causes the printer to print the received data in hexadecimal. The printer prints 16 values in hexadecimal, followed by the corresponding ASCII characters, on one line. If there is no corresponding printable character for a value (i.e. a control code), a period (.) is printed. Any remaining data (less than 16 values) can be printed by operating the ON LINE switch. No panel settings can be made in the hexadecimal dump mode. This function makes it easy for technician to identify the source of communications problems between the printer and computer.

Table 1-24 lists the self test operating instructions and Figure 1-9 shows the hexadecimal dump printing.

Table 1-24. Hexadecimal Dump Operation

Function	Operation	stop
Hexadecimal dump mode	Turn the power ON while pressing both the LINE FEED and FORM FEED switches	● Press the ON LINE switch to set the printer off line. Next, turn off the printer.

```
Data Dump  Mode
0000  1B 40 00 1B 55 00 1B .33 1E 00 OD 0A 12 1B 70 00   .@..U..3......p.
0001  1B 7e 01 1B 57 00 1B 4D 20 20 20 43 48 41 50 54   .x..W..M   CHAPT
0002  45 52 20 31 0D 0A 0D 0A 20 20 20 28 31 2E 0D 0A   ER 1.... ( 1...
0003  0 D 0A 20 2,) 20 31 2E 31 20 20 4& 65 61 74 75 72   ..   1.1 Featur
0004  6S 73 0D 0A 20 20 20 54 68 65 20 46 58 2D 38  .35   es..   The FX-85
0005  30 20 61 6E 64 20 46 58 2D 31 30 35 30 ·20 61 72   0 •nd FX-1050 ar
0006  &,5  20 73 65 72 69 61 6C 20 64 6F 74 20 6D 61 74   e serial dot mat
0007  72 69 78 20 39 2D 70 69 6E 20 74 65 72 6D 69 6E   rix 9-pin termin
0008  61 6C 20 70 72 69 6E 74 65 72 73 20 74 68 61 74   •l printers that
0009  OD 0A 20 20 20 70 72 69 6E 74 20 61 74 20 61 20   ..   print at •
000A  6D 61 78 69 6D 75 6D 20 6F 66 20 32 36 34 20 4.3   maximum of 264 C
000B  50 53 2E 20 20 45 69 74 68 65 72 20 6D 6F 64 65   Ps.  Either mode
000C  6C 20 46 58 2D 3S 35 30 20 77 69 74 68 20 3S 30   1 FX-850 with 80
000D  20 63 6F6C 75 6D 6E 73 20 6F 72 20 46 58 2D OD    columns or FX-.
O W E  0A 20 20 20 31 30 35 30 20 77 69 74 68 20 31 33      1050 with 13
000F  36 20 63 6F 6C 75 6D 6E 73 20 63 61 6E 20 62 65   6 columns can be
0010  20 73 65 6C 65 63 74 65 64 20 61 63 63 6F 72 64    selected accord
0011  69 6E 67 20 74 6F 20 79 6F 75 72 20 72 65 71 75   ing to your requ
0012  69 72 65 6D 6S 6E 74 73 2E 20 20 s4 68 65 OD 0A   irements.  Thin. .
0013  20 20 20 6D 61 69 6E 20 66 65 61 74 73 72 65 73      main features
0014  20 61 72 65 20 61 73 20 66 6F 6C 6C 6F 77 73 3A    •ra as fol lows :
0015  OD 0A OD 0A 20 20 20 2A 20 4D 61 78 2E 20 70 72   ....   * Max . pr
0016  69 6E 74 69 6E 67 20 73 70 65 65 64 3A 20 20 32   inting speed : 2
0017  36 34 20 43 50 53 20 28 44 72 61 66 74 20 61 6E   64 CPS ( Draft •n
0018  64 20 45 6C 69 74 65 29 OD 0A 20 20 20 20 20 20   d Elite) . .
0019  20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
001A  20 20 20 20 20 32 32 30 20 43 50 53 20 28 44 72        220 CPS ( Dr
001B  61 66 74 20 61 6E 64 20 50 6? 63 61 29 OD 0A 0D   •ft and Pica) . . .
001C  0A 20 20 2,> 2A 20 41 64 76 61 &E 63 65 64 20 70      * Advanced p
001D  61 70 65 72 20 68 61 6E 64 6C 69 6E 67 20 66 75   •per handl ing fu
001E  6E 63 74 69 6F 6E 7S 3& 20 20 41 75 74 6F 20 74   nctions:  auto t
001F  65 61 72 2D 6F 66 66 OD 0A 20 20 20 20 20 20 20   ear-off . .
0020  20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
0021  20 20 20 20 20  20  20  20 20 20 20 20 213 20 20 20
0022  20 20 41 75 74 6F 20 6C 6F 61 64 69 6E 67 OD 0A      Auto loading. .
0023  20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
0024  20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
0025  20 20 20 20 20 20 20 20 20 41 75 74 6F 20 62 61          Auto ba
0026  63 6B 2D 6F 75 74 OD 0A 20 20 20 20 20 20 20 20   ck-out . .
0027  20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
0028  20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
0029  20 4D 69 63 72 6F 20 61 64 6A 75 73 74 60 65 6E    Micro adjustmen
002A  74 OD 0A 0D 0A 20 20 20 2A 20 53 65 6C 65 63 54   t....   * SelecT
002B  79 70 65 20 66 75 6E 63 74 69 6F 6E 20 28 41 6E   ype function (An
002C  7? 20 70 72 69 6E 74 20 6D 6F 64 65 20 63 61 6E   y print mode can
002D  20 62 65 20 73 65 6C 6.5 6.3 74 65 64 20 64 69 72    be selected dir
002E  65 63 74 6C 79 20 66 72 6F 6D 20 74 68 65 20 66   ● ctly from the f
002F  72 6F 6E 74 OD 0A 20 20 20 20 20 70 61 6E 65 6C   rent. .      panel
0030  29 2E 20 20 4F 6E 6.3 65 20 61 20 6D 6F 64 65 20   ).  Once • mode
0031  69 73 20 73 65 6C 65 63 74 69 64 2C 20 &9 74 20   is selected, it
0032  69 73 20 73 74 6F 72 6S 64 20 69 6E 20 74 68 65   is stored in the
0033  20 6E 6F 6E 2D 76 6F 6C 61 74 69 6C 65 20 6D 65    non-volatile me
0034  6D 6F 72 79 2C OD 0A 20 20 20 20 61 6E 64 20   mory, . .    •nd
0035  69 73 20 73 65 6C 65 63 74 65 64 20 77 68 65 6E   is selected when
0036  20 74 68 65 20 70 72 69 6E 74 65 72 20 70 6F 77    the printer pow
0037  65 72 20 69 73 20' 74 75 72 6E 6S 64 20 6F 6E 2E   er is turned on.
0038  OD 0A OD 0A 20 20 20 2A 20 S4 77 6F 20 4E 4C 51   ....   * Two NLQ
0039  20 66 6F 6E 74 73 20 28 52 6F 6D 61 6E 20 61 6E    fonts (Roman•n
003A  64 20 53 61 6E 73 2D 73 65 72 69 66 29 20 61 72   d Sans-seri f ) •r
003El 6520 73 74 61 6E 64 61 72 64 2E OD 0A OD 0A 20   e standard. . . . .
```

Figure 1-9. Hexadecimal Dump Printing

1.7 PRINTER INITIALIZATION

There are two initialization methods: hardware initialization and software initialization.

1.7.1 Hardware Initialization

This type of initialization occurs when printer power is turned on or when the printer receives the INIT signal from the host computer via the 8-bit parallel interface.
When printer is initialized in this way, it performs the following actions:

- **Initializes printer mechanism.**
- **Sets the on-line mode.**
- **Sets the page length to 11 or 12 inches according to the DIP switch.**
- **Clears the input data buffer and print buffer.**
- **Read DIP switch and jumper settings.**
- **Sets the print mode according to the DIP switch and the non-volatile memory set by control panel.**
- **Sets printer selections to their default values**

1.7.2 Software Initialization

This type of initialization occurs when the printer receives command (ESC @) via software.
When the printer is initialized in this way, it performs the following actions:

- **Clears the print buffer.**
- **Sets printer selections to their default values.**

NOTE: The printer's default values are as follows:

Page Position	**Preset paper position becomes top of form position**
Left and Right Margin	**Released**
Line Spacing	**1/6 inches**
Vertical Tab Position	**Cleared**
Horizontal Tab Position	**Every 8 characters (relative)**
VFU Channel	**Channel O**
Family Number of Type Style	**Roman (Family Number O)**
Downloaded Characters	**Deselected: Software initialize**
	Cleared: Hardware initialize
Justification	**Left justification**
Character Per Inch	**10**
Bit Image Mode Assignment	**ESC K = ESC * O, ESC L = ESC * 1, ESC = ESC * 2,**
	ESC Z = ESC * 3
Printing Effects	**Cleared**

1.8 BUZZER OPERATION AND ERROR CONDITIONS

This section describes the buzzer operation and error conditions of the printer.

1.8.1 Buzzer Operation

The buzzer beeps as follows:

- **When a BEL code is sent to the printer, the buzzer sounds for 0.1 second.**
- **When the following error has occured:**

  Carriage Trouble ..... **Beeps 6 times, pausing briefly after 3rd beep.**

  Paper End ..... **Beeps 20 times, pausing briefly after every 4 beeps.**

  Abnormal Voltage ..... **Beeps 5 times, pausing every beep.**

  RAM Error ..... **Beeps 6 to 10 times, pausing briefly after every 2 beeps. The beeps warn which RAM is incorrect as follows:**

  6 times ..... **Internal RAM (CPU)**

  8 times ..... **Lower Address RAM (IC)**

  10 times ..... **Upper Address RAM (IC)**

  Short circuited printhead drive transistor ..... **Beeps 10 times, pausing after every beep.**

- **Recognition of the control panel operation**

  Beeps once in the following cases:

  Self print mode

  Hexadecimal dump mode

  Print mode setting

- **Proportional space alternation**

  Beeps once when old proportional space is selected and twice new one is selected.

1.8.2 *Error Conditions*

The printer enters an error state and sets the ERROR signal LOW and BUSY signal HIGH to prohibit reception of data when any of the following states occurs.

- **The carriage home signal is not detected after the printer mechanism has been initialized (carriage error).**
- **The carriage home position is detected during printing (carriage error).**
- **The printer is set OFF LINE using the ON LINE switch.**
- **An internal DC voltage drop is detected (abnormal voltage is detected).**
- **During initialization, an error is detected by a READ/WRITE check of the RAM in the control circuit.**
- **A printhead drive transistor is shorted.**

Interface signal PE is also set HIGH in addition to the above error sequence when any of the following states occurs.

- **The printhead is moved outside of the printable area by a forms override function (paper end state).**
- **The paper end state continues after the cut sheet feeder mode has been set and paper loading has been completed (paper end state).**

1.9 PAPER HANDLING FUNCTIONS

The push tractor unit can be easily mounted or removed using the paper release lever. Either continuous paper or cut sheets can be easily selected by operating the LOAD/EJECT switch and paper release lever. Various paper handling functions are described below.

1.9.1 Autoloading and Backout Function

Loading and ejecting a cut sheet:
When no sheet is loaded, push the paper release lever backward, load the sheet along the sheet guide, and press the LOAD/EJECT switch so that the sheet is automatically fed up to the TOF position.

When the LOAD/EJECT switch is pressed with a sheet loaded, the sheet will be ejected.
Loading and ejecting continuous paper (auto back-out):
Pull the paper release lever forward, load continuous paper onto the push tractor unit, and press the LOAD/EJECT switch so that the paper is automatically fed up to the TOF position.
When the LOAD/EJECT switch is pressed with the paper loaded, the paper is fed in the reverse direction (ejected) up to the tractor waiting position (auto back-out). If the paper cannot be fed in the reverse direction at 1/6 inch line spacing, the paper ejection process will be terminated.

1.9.2 Short Tear-Off Function

For continuous paper (when the paper release lever is moved to the tractor feeder side), the paper will be automatically fed to the perforations (tear-off position) when printing is completed, no data is being received from the host computer, and the print buffer is empty. At this time, the micro-adjustment TOF set function becomes valid so that the tear-off position can be adjusted accurately using the LF and FF switches. The adjusted tear-off position is stored in the memory and remains valid even after the printer power is turned off, so that the paper will be automatically fed to that position when the tear-off function is executed later.
After the paper is cut off, the paper is automatically returned to the previous position by sending new print data or setting the printer OFF LINE.

1.9.3 Micro-Adjustment Top-of-Form Set Function

After paper loading is completed, set the printer ON LINE by pressing the ON LINE switch. In this state, the paper loading position can be finely adjusted by operating the LF and FF switches. When the printer is in the micro adjustment mode, the ON LINE LED on the panel blinks. The paper loading position can be adjusted individually for the friction feed, tractor feed, and cut sheet feeder modes, and the adjusted values are stored in the memory. The value for the tractor feed remains valid even after the printer power is turned off.
NOTE: If paper is already loaded when the printer power is turned on, the position of the paper will be recognized as the TOF position.

1.10 PAPER END DETECTION

The paper end is detected by the PE sensor. When the paper end is detected, the printer indicates it by lighting the lamp on the control panel and ringing the buzzer. The printer sets the parallel interface signals as shown below, and enters the OFF LINE mode.

- BUSY signal: HIGH
- PE signal: HIGH
- ERROR signal: LOW

After the paper end is detected, load a new sheet and press the ON LINE switch so that the printer enters the ON LINE mode. Figure 1-10 shows the paper end detection position.

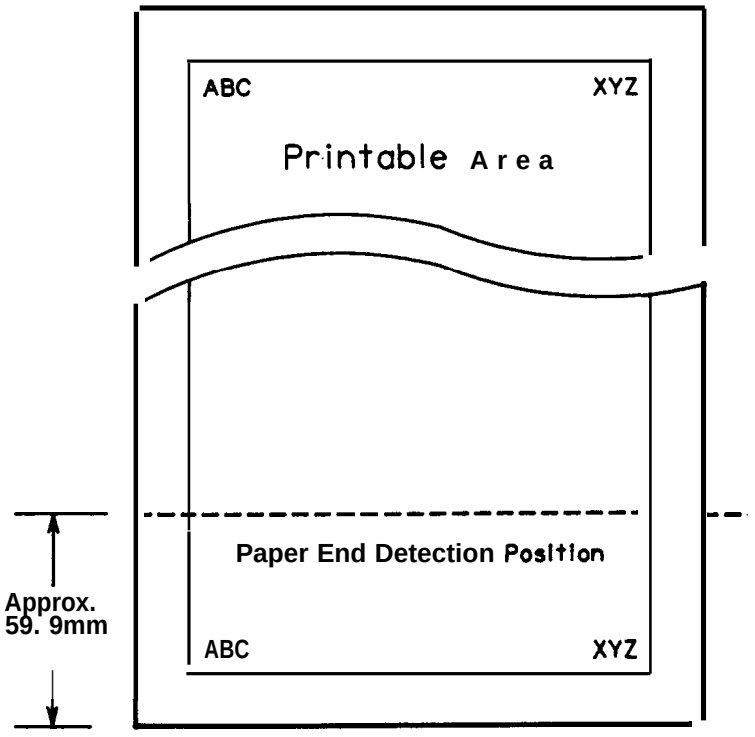


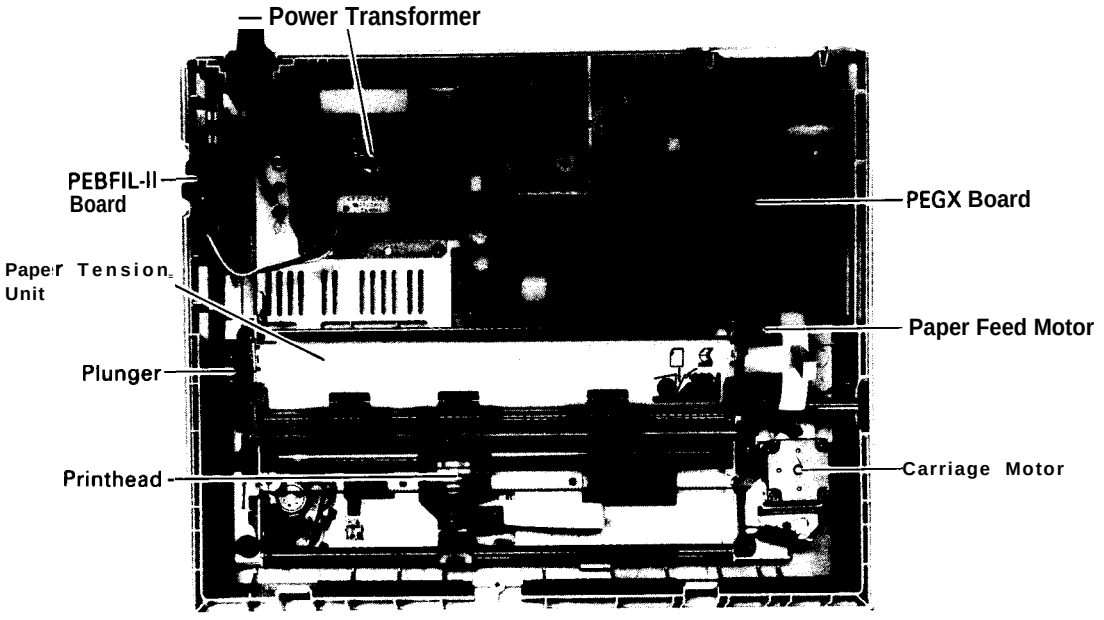
Fig. 1-10. Paper End Detection Position

1.11 MAIN COMPONENTS

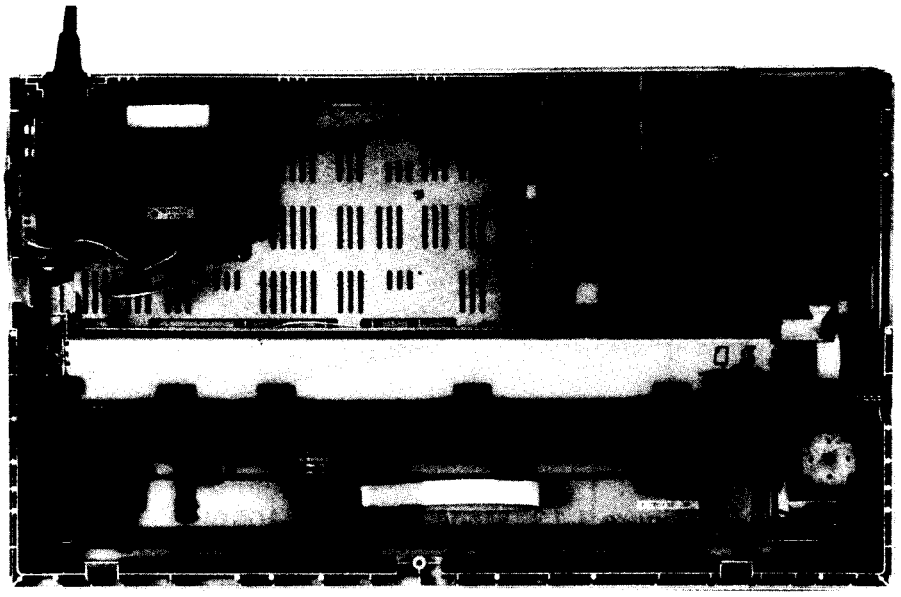
The FX-850/1 050 printer includes the following major subassemblies:

- Model-3B 10\3B60 printer mechanism
- PEGX board (main board)
- PGPNL board (control panel)
- PEBFIL-II board (filter board) and power transformer
- Housing

Figure 1-11 shows the FX-850/1 050 component locations.



FX-850



FX-1 050

NOTE: In FX-850, the paper tension unit and push tractor unit are excluded.

Figure 1-11. Component Locations

1.11.1 Printer Mechanism

The Model-3B10 (FX-850)/3B60 (FX-1050) are 9-pin dot matrix printer mechanisms, and feature a wide range of usable paper, light weight, compact size, and advanced paper handling function. These mechanisms are based on printer mechanisms Model-5310/5360 for the LQ-850/1050. The optional pull tractor unit or cut sheet feeder can be mounted to the mechanism. Since the construction of these printer mechanisms are simplified, maintenance is very easy.

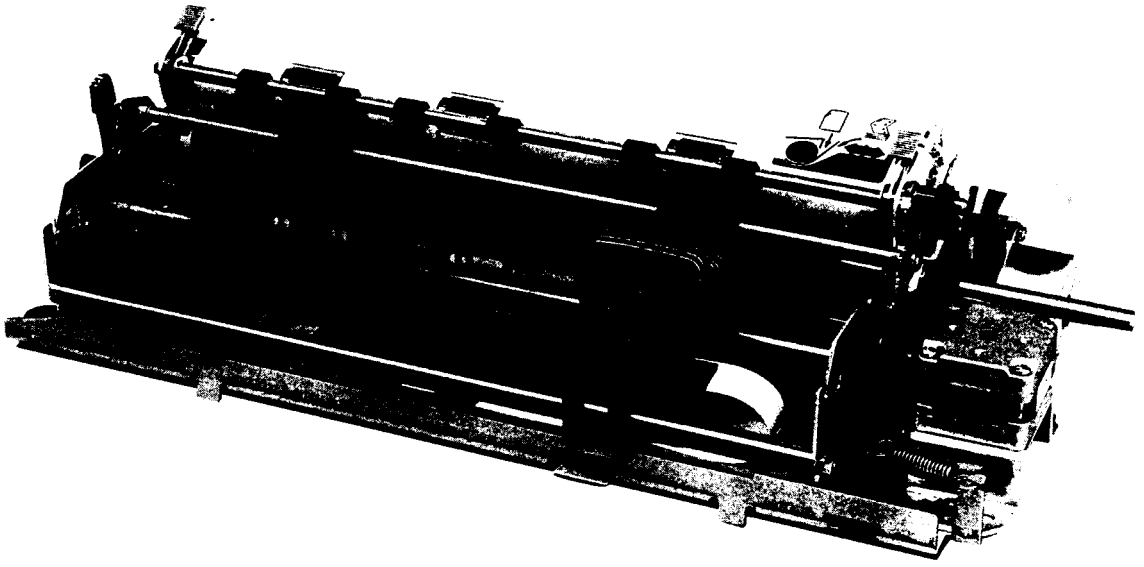


Figure 1-12. Model-3B10 (FX-850)

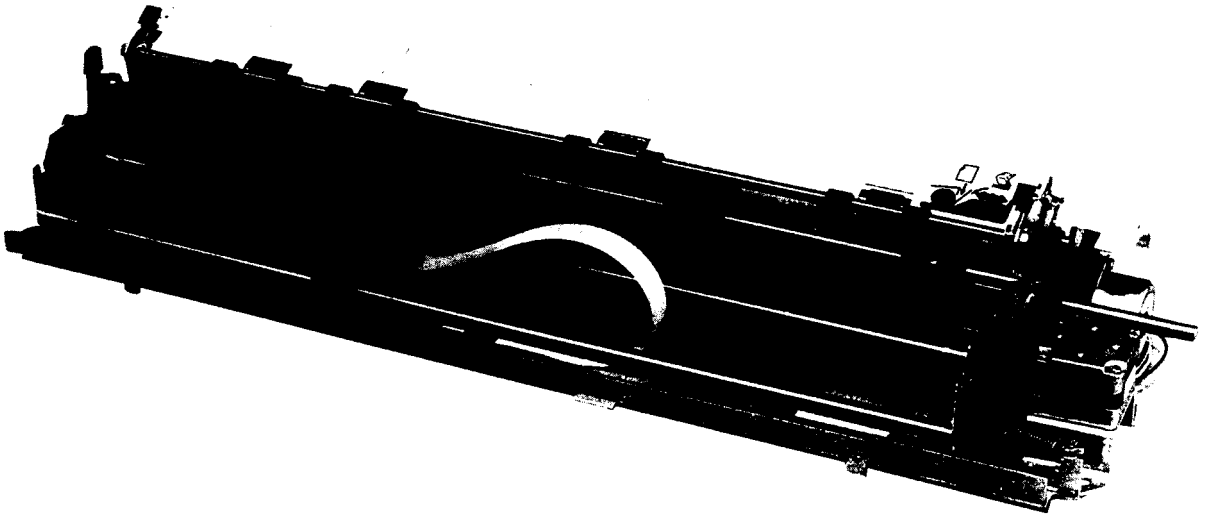


Figure 1-13. Model-3B60 (FX-105O)

1.11.2 **PEGX** *Board (Main Board)*

The PEGX board is the main board, and interfaces the printer to the host computer, controls the printer mechanism and control panel, and supplies DC voltage. Since the complicated logic circuit section is implemented using gate arrays, the PEGX board features very compact construction.
Driver circuits for the motors, sensors, and printhead are also included on this board. Other main ICs on the PEGX board are:

Universal IC

- **STK6722HZ (IC2A)..... Carriage Motor Driver**
- **NJM2355 (ICIA)..... Switching Regulator IC**

Gate Array

- **E05A15HA (IC3A)..... Paper Feed and Carriage Motors controller, and Printhead driver**
- **E05A16GA (IC7A)..... Host computer interface**

Memory IC

- **EP-ROM (IC4A)..... Program ROM, 256 K-bit**
- **S-RAM (IC5A and 6A)..... Buffer and Back up memory**

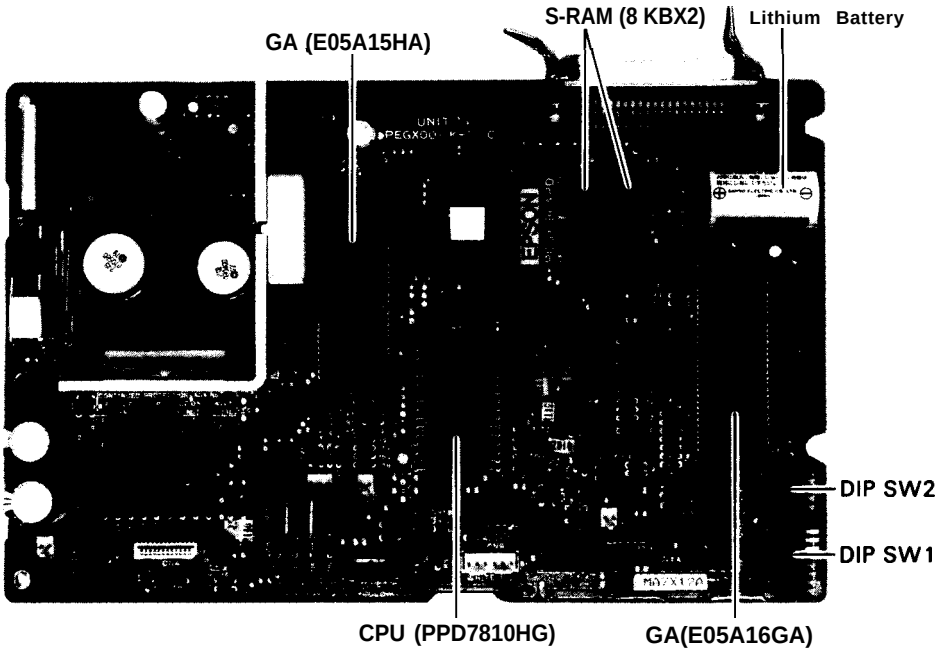
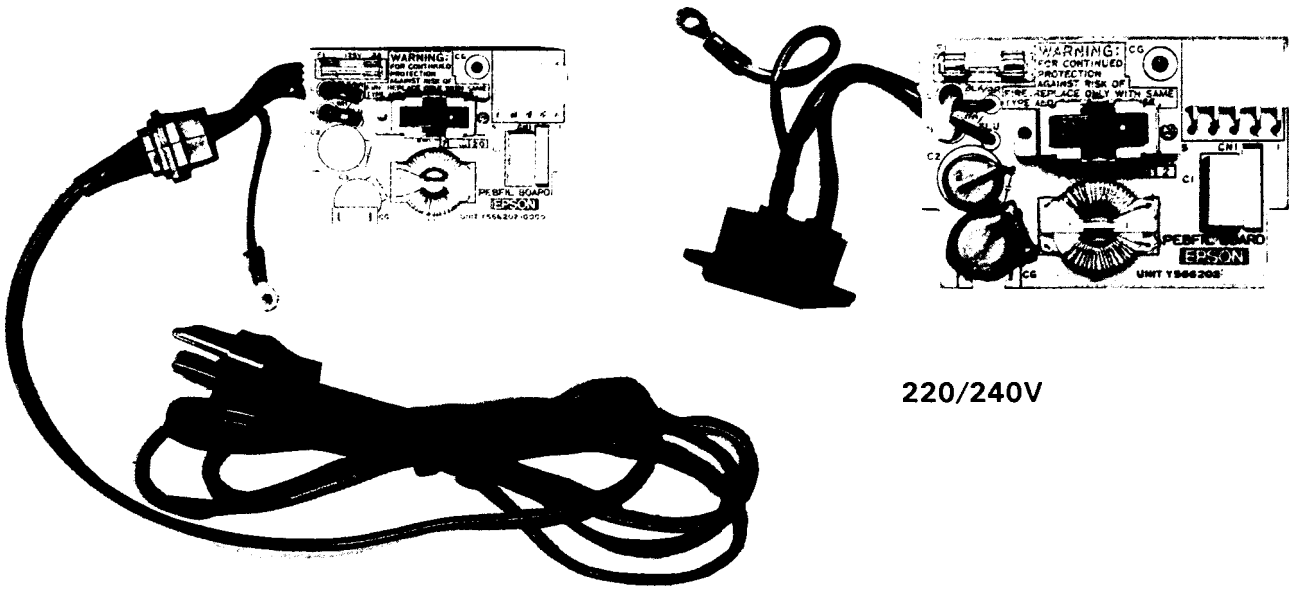


Figure 1-14. PEGX Board

1.11.3 PEBFIL-II Board (Filter Board) and Power Transformer

The DC power supply circuit is on the main board. The PEBFIL-II board and power transformer remove noise from the AC power supply section and drop the AC input voltage.
Figure 1-15 shows the PEBFIL-II board and power transformer.



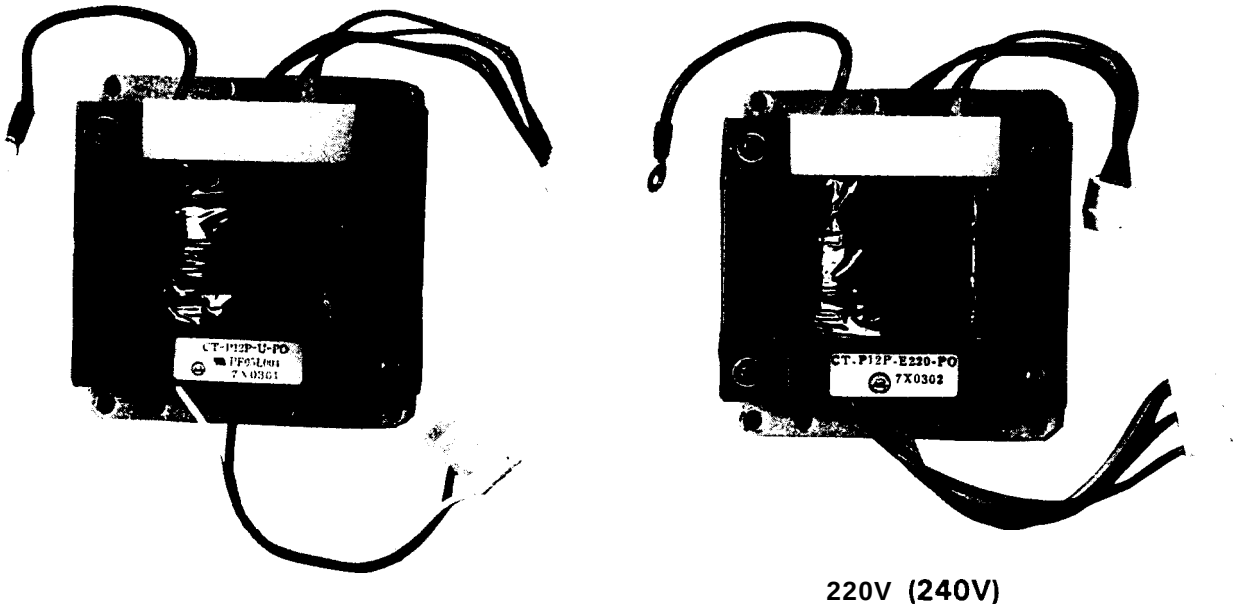


Figure 1-15. PEBFIL-II Board and Power Transformer

1.11.4 PGPNL Board (Control Panel)

There are 11 LEDs, seven switches, and a buzzer on the control panel. Among these, seven LEDs and three switches are for the panel setting function (SelecType). Font, character pitch, and condensed mode can be selected directly using these switches. Settings set using the SelecType mode are stored in the memory and are set on the panel when the printer hardware is initialized. Normally, the SelecType function is valid when not printing. The printers have various other functions that can be selected from the control panel.

Figure 1-16 shows the control panel.

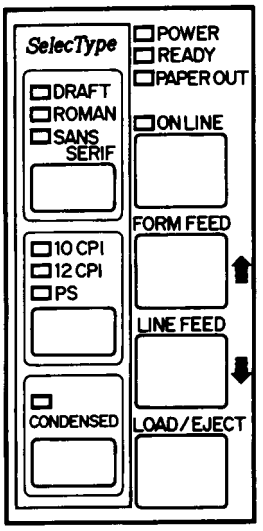


Figure 1-16. Control Panel

Switches

ON LINE ..... **This button controls the printer's on line/off line status. When the printer is on line, ONLINE light is on and the printer can receive and print data from the computer. When this lamp is flickering, the micro adjustment function can be used.**

FORM FEED ..... **When the printer is off line, press this button to eject a single sheet of paper or to advance continuous paper to the top of the next page.**

LINE FEED ..... **When the printer is off line, press this button to advance the paper one line, or hold it down to advance the paper continuously.**

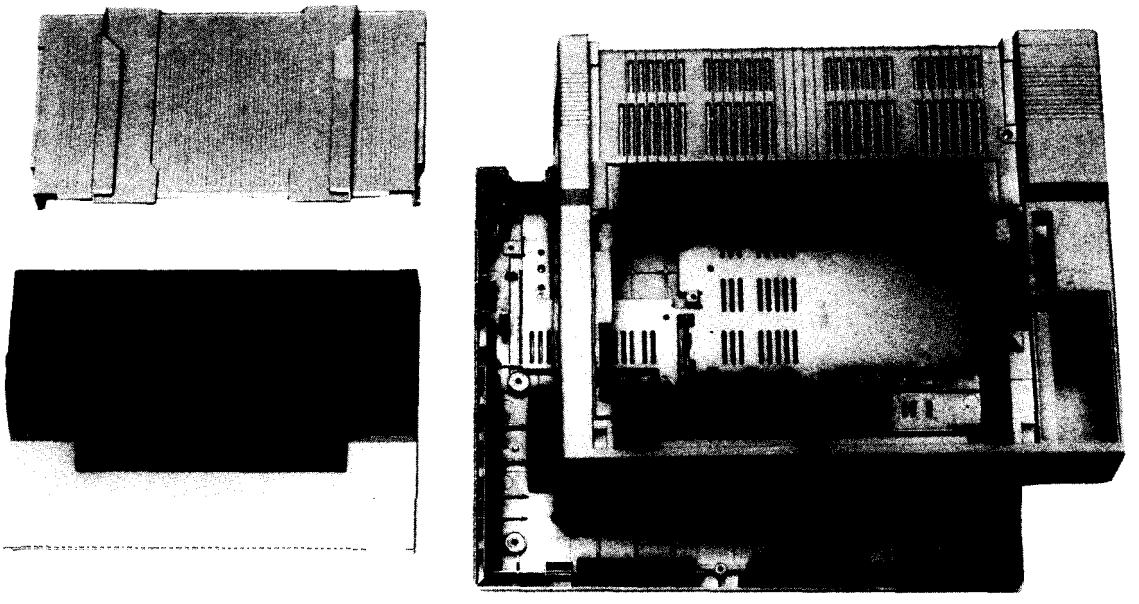
LOAD/EJECT	This button is used to feed the paper to the loading position or to eject paper when paper is already loaded. Paper is ejected forward if the paper release lever is set to the single sheet position, and is ejected backward (removed from the paper path) if the release lever is set to the continuous paper position.
FONT	This button is used to select NLQ ROMAN, NLQ SANS-SERIF, or DRAFT mode. The yellow indicator light shows the selected font.
PITCH	This button is used to select 10 CPI, 12 CPI, or PS (proportional) spacing. The yellow indicator light shows the selected pitch.
CONDENSED	This button is used to select or deselect the condensed mode. The yellow indicator light is on when the printer is in the condensed mode. In this mode all characters are printed at approximately 60% of their normal width.

LEDs

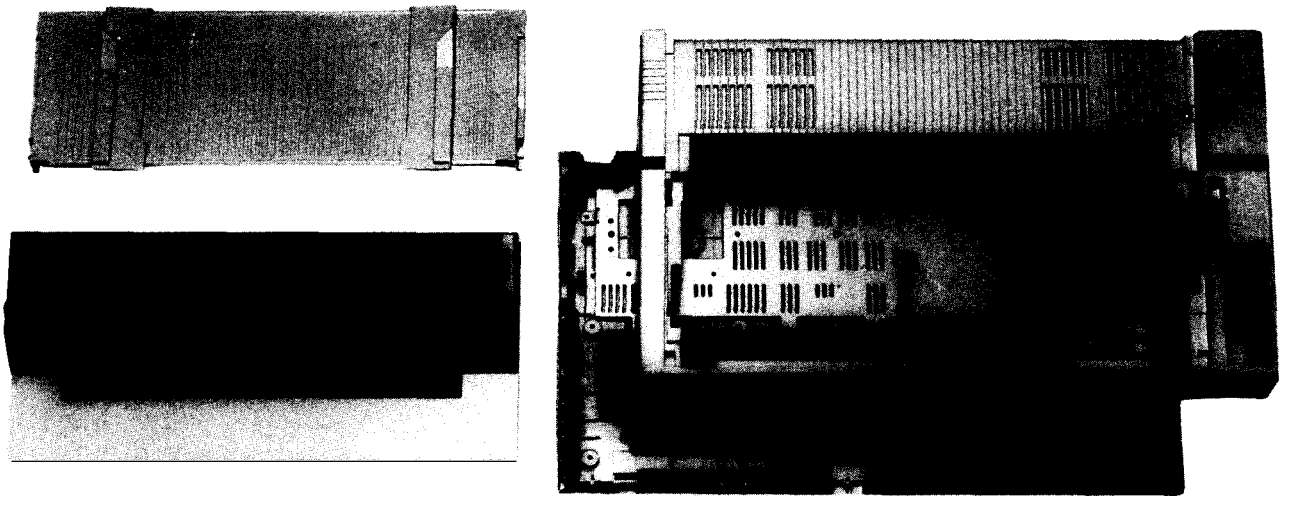
POWER (Green)	On when the POWER switch is on, and power is supplied.
READY (Green)	On when the printer is ready to accept input data. This LED flickers while data is printed.
PAPER OUT (Red)	On when the paper end sensor detects that the printer is out of paper.

1.11.5 Housing

The housing consists mainly of the upper and lower cases. The components described in the former sections (1. 11.1 through 1.11 .3) are accommodated in the lower case. Other components are the paper feed knob, paper separator, and printer cover. The DIP switch position is changed from the rear side of the printer (conventional) to the right side. A removable cover is located on the upper case so that the DIP switches on the optional board can be set without removing the upper case.
Figure 1-17 shows the upper and lower cases.



FX-850



FX-1 050

Figure 1-17. Housing

CHAPTER 2
OPERATING PRINCIPLES

LIST OF FIGURES

LIST OF TABLES

2.1 GENERAL

This chapter describes the operation of each component. Section 2.2 and the subsequent sections give more detailed descriptions of each component.

2.1.1 Cable Connections

The printer components are connected to and controlled by the PEGX board. Figure 2-1 shows the interconnection of the components.

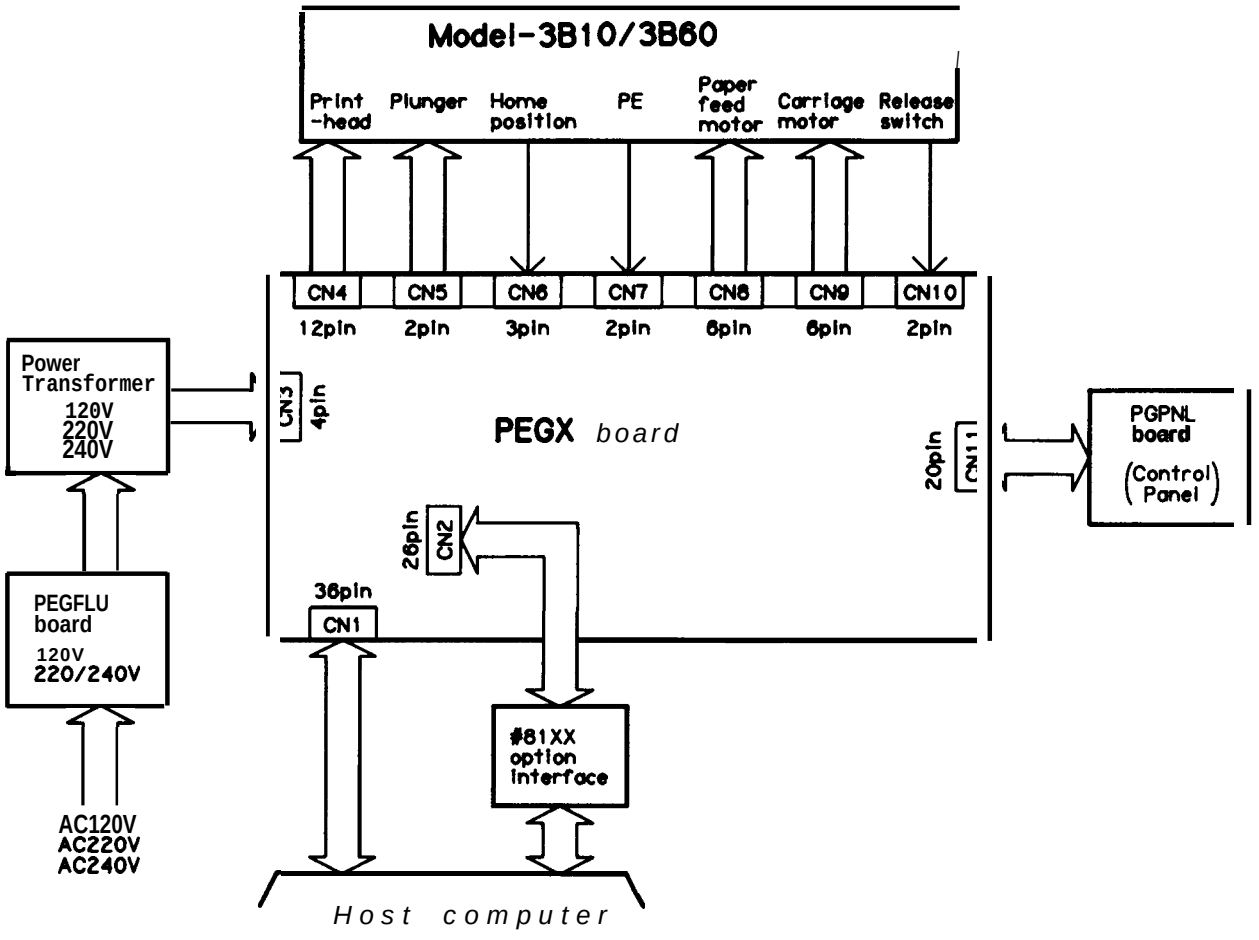


Figure 2-1. Cable Connections

Each component is connected to one of the connectors on the PEGX board, which are listed in Table 2-1. Table 2-1 describes the connectors.

Table 2-1 Board Connector Summary

Circuit Board	Connector Number	Description	Number of Pins	Reference Table
PEGX board	CN 1	Standard 8-bit parallel interface connector. Used for data transfer from the host computer.	36	Table A-1 5
	CN2	Connector for the optional interface board. Used for data transfer from the host computer. When the optional interface board is mounted, CN 1 is invalid.	26	Table A-1 6
	CN3	Supplies two step-down AC voltages from the power supply transformer to the DC regulator circuit on the PEGX board.	4	Table A-1 7
	CN4	Drives the printhead needles.	12	Table A-1 8
	CN5	Drives the plunger that opens and shuts the paper bail on the printer mechanism.	2	Table A-1 9
	CN6	Transfers the state of the carriage home position sensor from the printer mechanism to the control circuit on the PEGX board.	3	Table A-20
	CN7	Transfers the state of the paper end sensor from the printer mechanism to the control circuit on the PEGX board.	2	Table A-2 1
	CN8	Drives the paper feed motor.	6	Table A-22
	CN9	Drives the carriage motor.	9	Table A-23
	CN 10	Transfers the state of the release lever from the printer mechanism to the control circuit on the PEGX board.	2	Table A-24
	CN 11	Interface connector between the PEGX board and the control panel.	20	Table A-25

2.2 PRINTER MECHANISM OPERATION

The printer mechanism is a 9-pin serial dot matrix impact mechanism. Figure 2-2 shows a drawing of the mechanism. The name in the rectangles indicate relationship between each mechanism and the control circuit on the PEGX board.

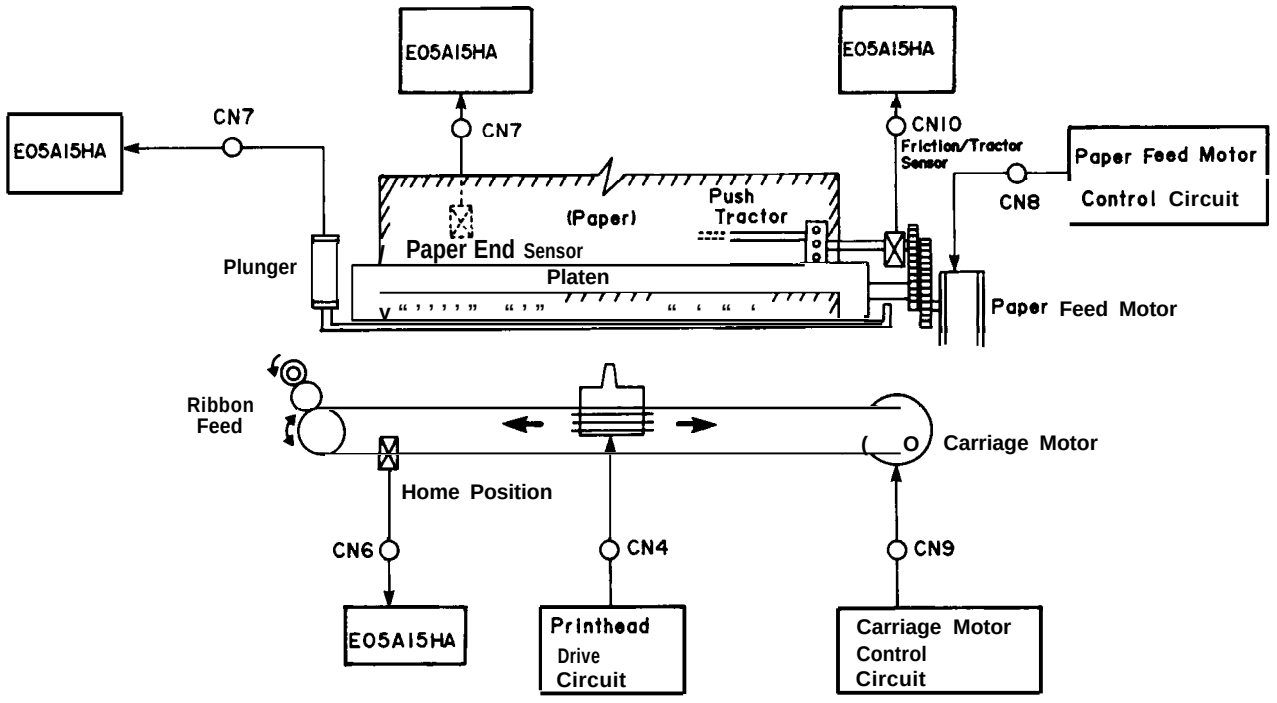


Figure 2-2. Printer Mechanism Block Diagram

The printer mechanism is composed of the following:

- **Printhead**
- **Carriage Mechanism**
- **Home Position Sensor**
- **Ribbon Feed Mechanism**
- **Paper Feed Mechanism**

2.2.1 Printhead

The printhead is an electromagnetic induction 9-pin serial dot head. Nine dot wires are driven individually to print a dot pattern on the paper, positioned between the platen and ribbon, by hitting the ink ribbon against the paper and the platen. Print data expanded on the PEGX board is converted into dot-image data for one vertical row, and output to the printhead by the printhead drive circuit. A character is printed by serially printing the dot patterns for each vertical row in the horizontal direction as the carriage moves. Figure 2-3 shows the printhead mechanism

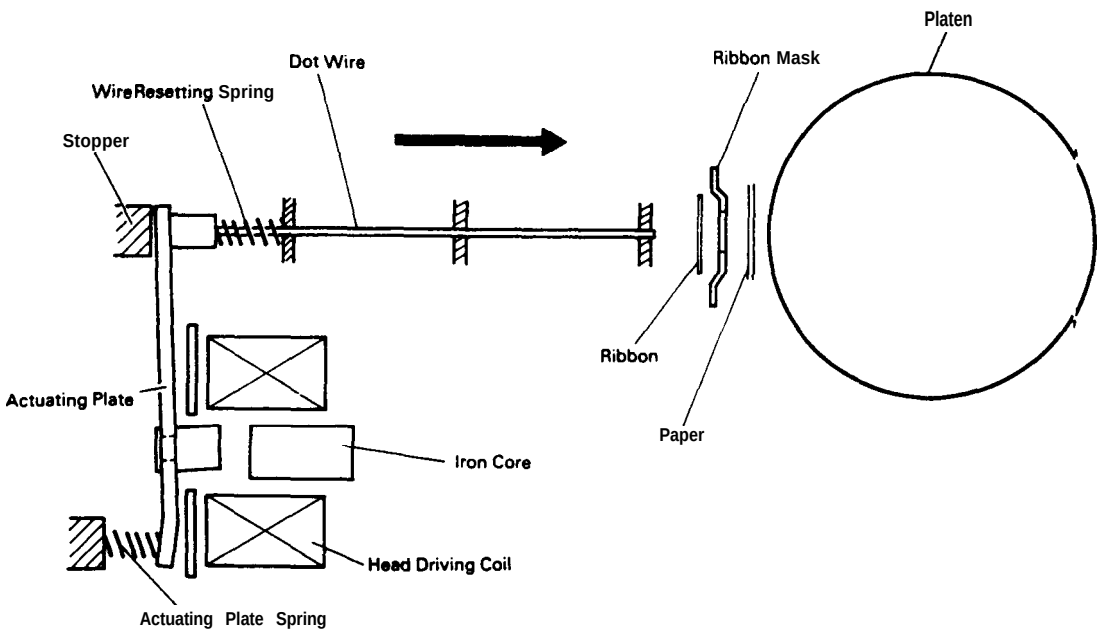


Figure 2-3. Printhead Mechanism

2.2.2 Carriage Mechanism

The carriage is driven by the carriage motor via a timing belt. The carriage moves left and right along the platen. Since a stepPer motor is used for the carriage motor, position. The carriage motor is controlled by a very simple, open-loop system.

Figure 2-4 shows the carriage mechanism.

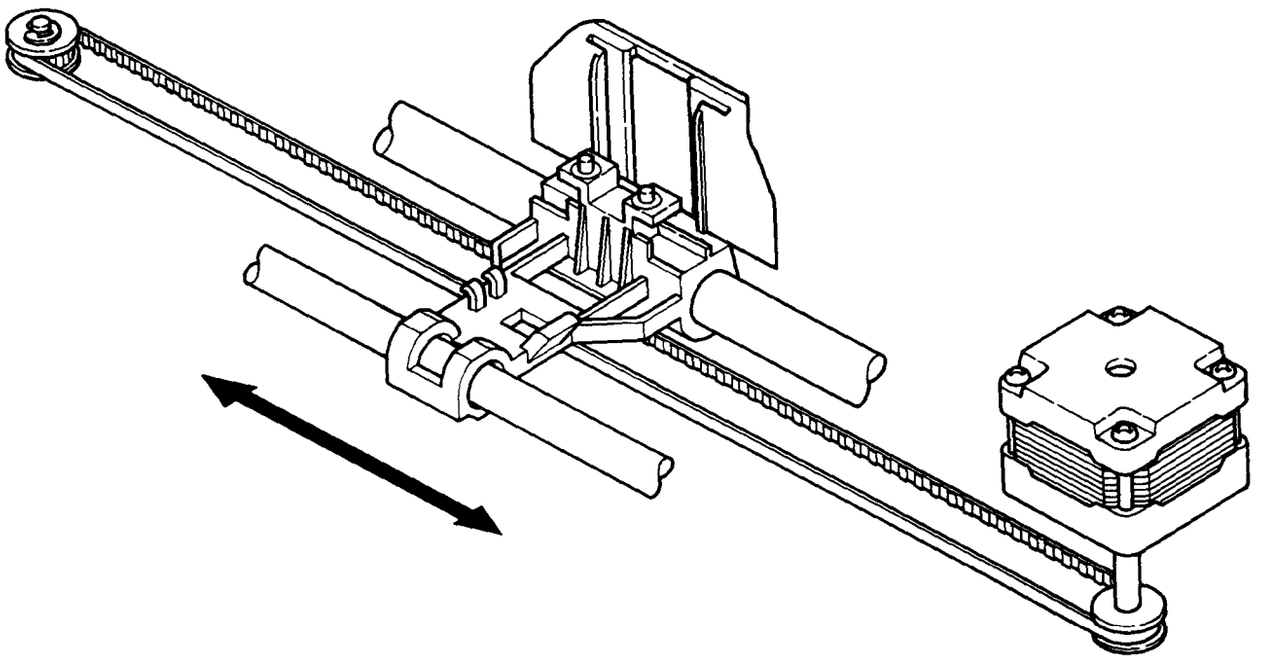


Figure 2-4. Carriage Mechanism

2.2.3 Home *Position* Sensor

The home position sensor detects the home position of the carriage. A home-Positio" seek is performed when the printer is initialized. The control circuit stores the home position, which is referenced to control the carriage motor position.

2.2.4 Ribbon Feed Mechanism

Carriage movement is conveyed to the series of gears in the ribbon feed mechanism. The ribbon feed mechanism converts bidirectional horizontal carriage movement into single directional rotational movement so that the ribbon can be taken up during printing. Figure 2-5 shows the ribbon feed mechanism.

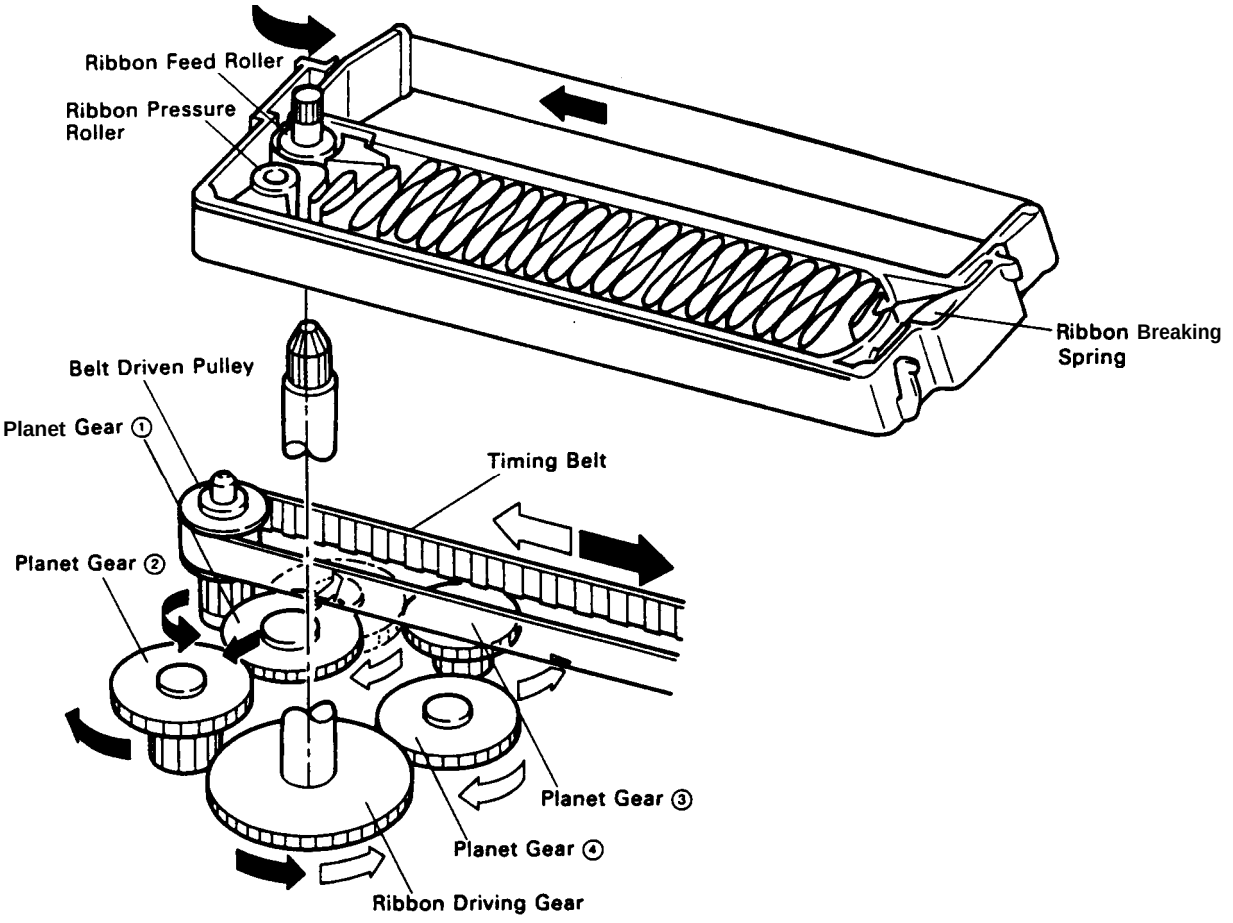


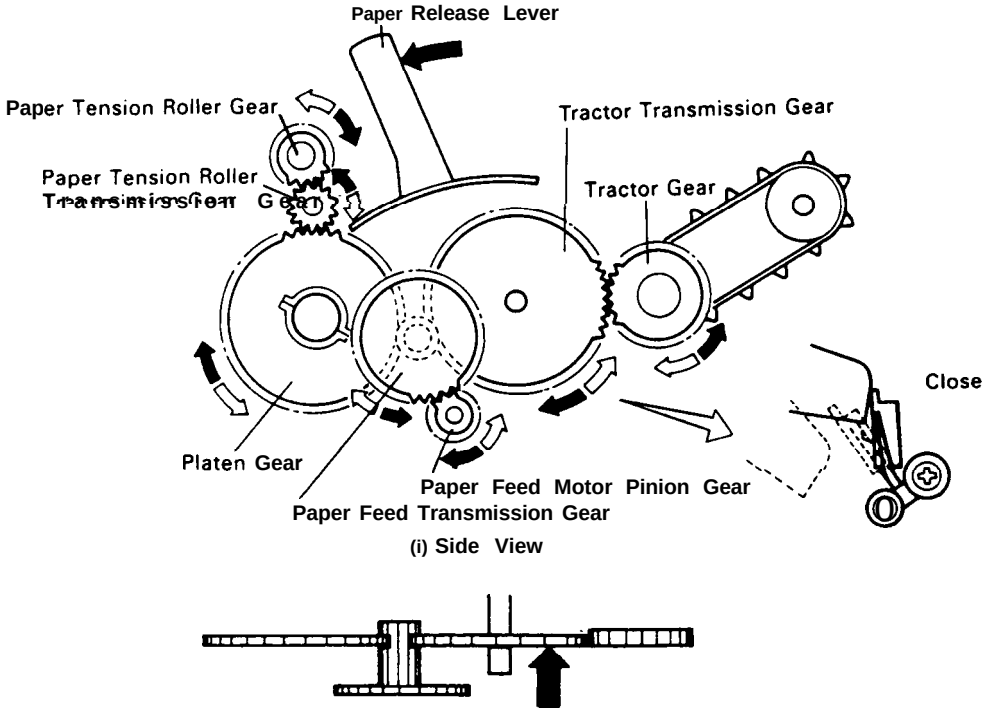
Figure 2-5. Ribbon Feed Mechanism

2.2.5 Paper Feed Mechanism

The paper feed mechanism is composed of the paper feed motor, platen, push tractor unit, paper tension unit, and release mechanism. Either the friction feed or tractor feed system can be selected depending on the paper used. (There are two paper entrances. One is for friction feed and the other is for tractor feed.) Rotational movement of the paper feed motor is conveyed to the platen in the case of friction feed, and to the push tractor unit (the platen also rotates) in the case of tractor feed. The conveyance mechanisms are switched using the release lever. The paper tension unit is mounted at the top of the platen, and is rotated by the paper feed motor. The paper ejection is assisted by friction between the platen and the paper tension unit.

2.2.5.1 Push Tractor Feeding Method (Figure 2-6)

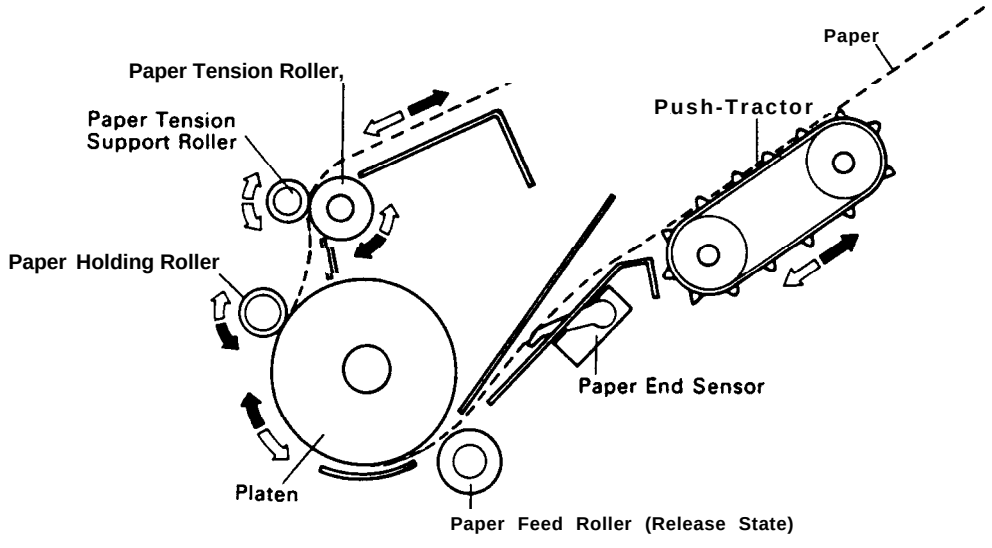
Paper feeding is performed by driving the paper feed motor with the paper release lever set forward to load fan-fold paper into the tractor unit. A paper tension unit is installed at the exit of the case to prevent irregular paper feeding and slackening.



(i) Side View

(ii) Top View

(a) Gear Arrangement

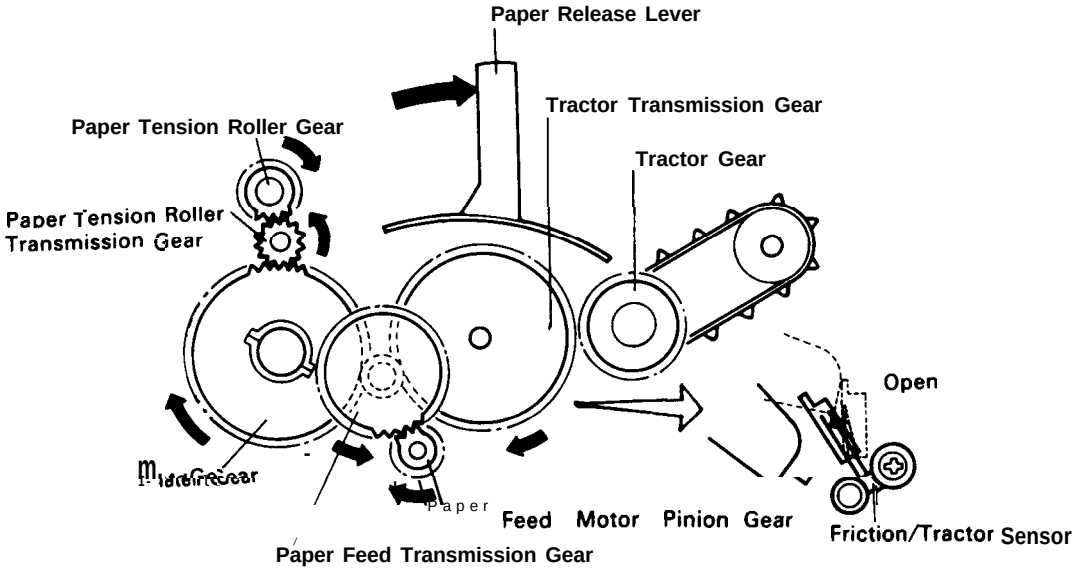


(b) Paper Path

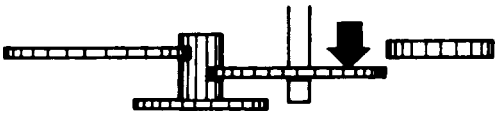
Figure 2-6. Push Tractor Feeding Method

2.2.5.2. Friction Feeding Method (Figure 2-7)

The paper is loaded from the upper paper entrance with the paper release lever set backward. The paper is held against the platen by the paper feed roller and is fed due to friction with the platen and paper feed roller. As in the push tractor feed method, the paper tension unit is used to prevent paper feed problems.

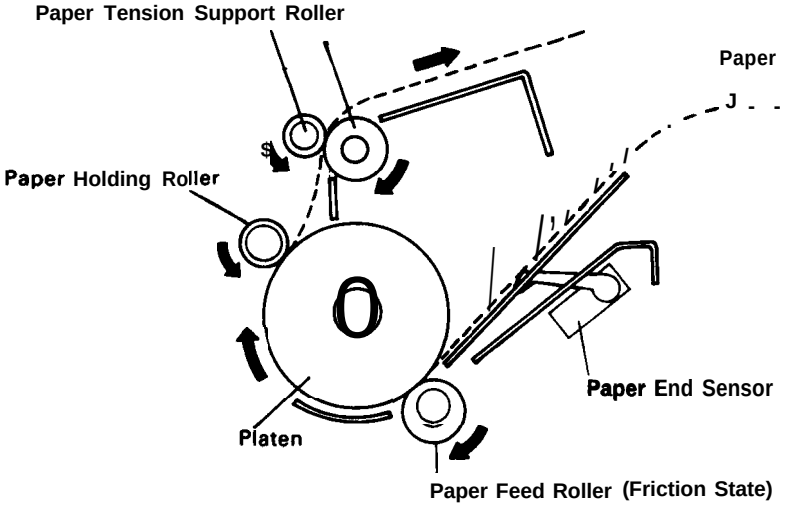


(i) Side View



(ii) Top View

(a) Gear Arrangement



(b) Platen Path

Figure 2-7. Friction Feeding Method

2.3 CIRCUIT OPERATION

The main circuits of the printer are on the PEGX board, the control panel, the PEBFIL-II board, and the power transformer.

2.3.1 General Information

The PEGX board includes the various circuits that supply DC voltage, control all of the printer operations and the control panel, and process data from the host computer.

2.3.1.1 Power Supply Section

Figure 2-8 shows a block diagram of the power supply section.

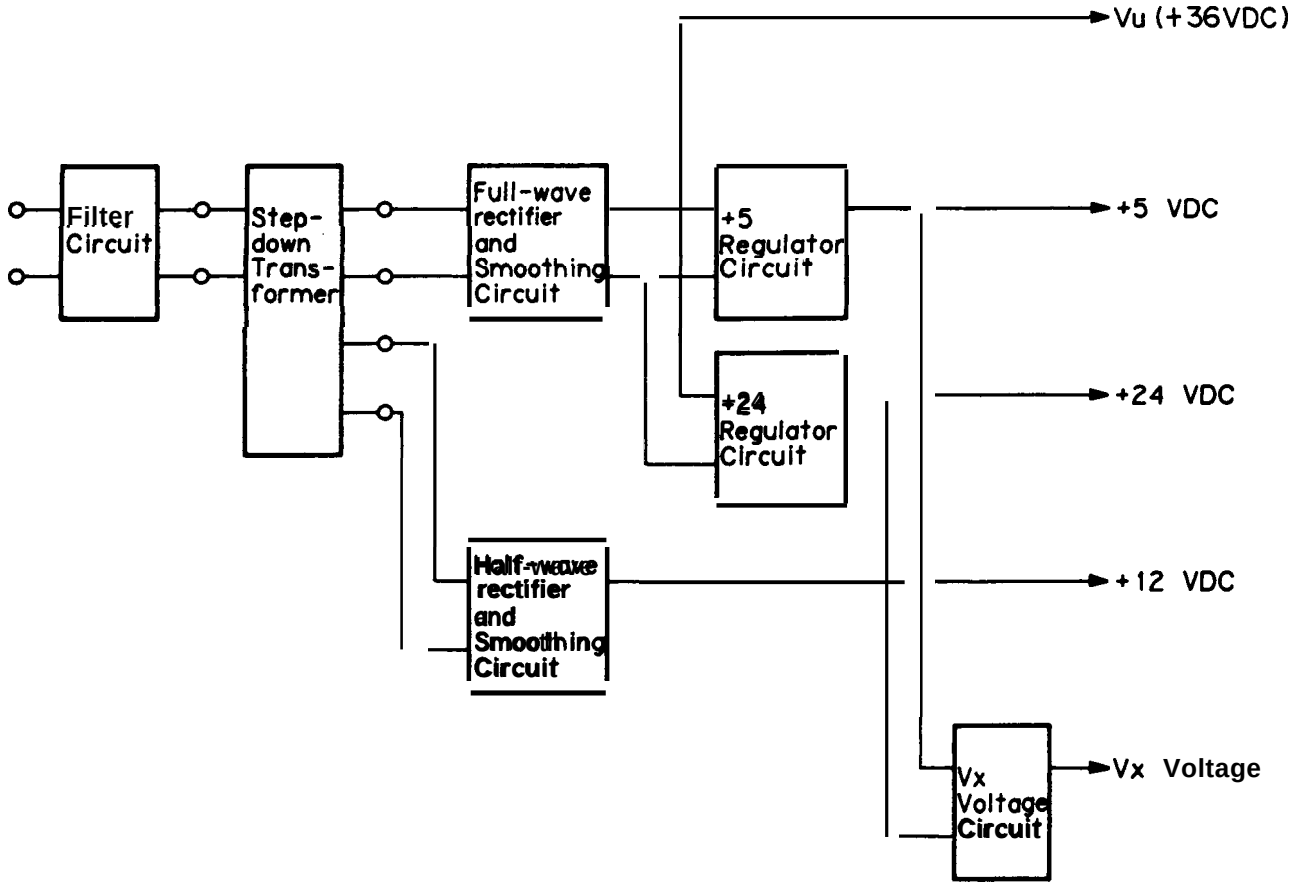


Figure 2-8. Power Supply Block Diagram

The power supply circuit is divided into the PEGX board, PEBFIL-II board, and power supply transformer. This circuit converts the AC voltage from the step-down transformer into the DC voltage required to drive the printer mechanism and operate the control circuits. The AC voltage from outside the printer is input to the step-down transformer via the filter circuit. The AC voltage is converted to 26 VAC and 12 VAC by the transformer, and is input to the power supply circuit on the PEGX board.

The 26 VAC is converted to approximately 36 VDC by the full-wave rectifier and smoothing circuit. The unregulated DC voltage and the regulated +24 VDC and + 5 VDC (total of 3 supplies) are supplied to the control circuit. Switching regulator IC NJ M2355 (1A) controls the chopper-type switching regulator circuits for +24 VDC and +5 VDC.

The +36 VDC and +5 VDC are supplied to the Vx voltage circuit, converted to the Vx voltage, and supplied to the reset circuit.

The 12 VAC is converted to unregulated 12 VDC by the positive half-wave rectifier and the smoothing circuit, and is supplied to the control circuit.

Table 2-2. Power Supply Application

Voltage	Application
+5V	Logic circuit Plunger solenoid holding voltage Paper feed motor holding voltage Signal pull-up voltage
+36V (vu)	Plunger solenoid driving voltage Paper feed motor driving voltage Carriage motor driving voltage
+24V (Vp)	Printhead driving voltage Option interface voltage
+ 12V - 12V	Option interface voltage

2.3.1.2 Control Circuit Section

Figure 2-9 shows the control circuit block diagram.

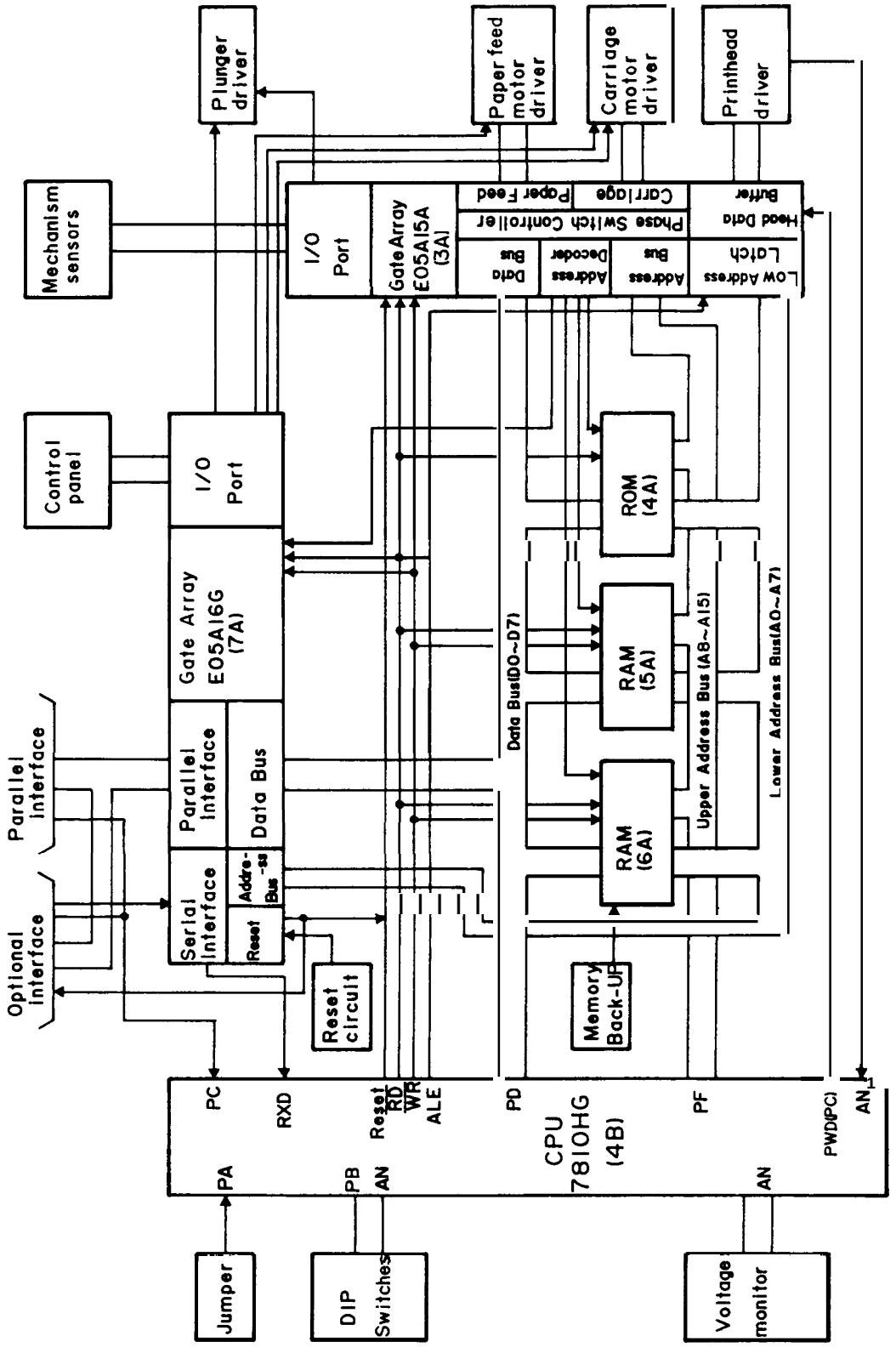


Figure 2-9. Control Circuit Block Diagram

The control circuit consists mainly of the following ICS:

- pPD7810HG CPU(4B)

  The μPD78 10HG CPU executes the program in the 27256 PROM (4A) and controls all of the printer operations. The CPU begins executing the program from address OOOOH upon receiving the reset signal. The CPU also reads the DIP switch and jumper settings and detects the states of the analog circuits.

- 27256 PROM (4A)

  The 27256 PROM includes the control program (firmware) and character generators.

- HM6264 SRAM (X 2) (5A/6A)

  The HM6264 SRAMs are external memories for the CPU. They are used as an input data buffer and line buffer for expanding data and as a working area for the program. (8K x 2 = 16K bytes)

- E05A16G gate array (7A)

  The E05A 16GA gate array controls handshaking for parallel data (including the optional interface), the control panel, plunger, speed of the carriage motor, and reset signal. The gate array also generates Italic and Super/subscript characters so that command processing speed is improved and the load on the firmware is lightened.

- E05A15HA gate array (3A)

  The E05A15HA gate array has address latch and address decode functions, and controls the memory. The gate array also controls the carriage and paper feed motors using the 2-channel automatic phase switching circuit. In addition, the gate array reads the states of the head data buffer, carriage home position sensor, paper end sensor, and release switch sensor.

Other control circuits are as follows:

- Reset circuit

  The reset circuit outputs the reset signal. The reset signal is sent to the CPU for the necessary time either when the printer power is turned on or when the I NIT signal is input from the host computer.

- Memory back-up circuit

  The memory back-up circuit backs up the panel settings and data for the top-of-form (TOF) position stored in the SRAM (6A) when the printer power is turned off, so that the values will remain valid when the printer power is turned on again. The DC voltage supplied to this circuit is monitored, and power is supplied from the battery for back-up when the main-power voltage level drops.

- Plunger drive circuit

  The plunger drive circuit drives the plunger using the plunger control signal. The plunger is controlled by switching the drive voltage on and off.

‘ Paper feed motor drive circuit

  The paper feed motor drive circuit drives the paper feed motor using the motor control signals. The paper feed motor is a 4-phase stepper motor. The rotation of the motor (position and speed) is controlled by outputting the phase switching signal generated by the E05A 15HA gate array and switching the common voltage (driving or holding).

- Carriage motor drive circuit

  The carriage motor drive circuit drives the carriage motor using the carriage motor control signals. The carriage motor is a 4-phase stepper motor. The rotation of the motor (position and speed) is controlled by outputting the phase switching signal generated by the E05A 15HA gate array and switching the common voltage (driving or holding).

- Printhead drive circuit

  The printhead drive circuit drives the printhead after expanding the printhead data. Data from the host computer is processed and expanded so that it is converted to dot data for one vertical row. Printing is executed by expanding the patterns for vertical rows as the carriage moves.

2.3.1.3 Memory Mapping

This printer is controlled by PEGX circuit board which equips pPD7810HG CPU with 64-K bytes of address space. Figure 2-10 shows a memory map of this address space.

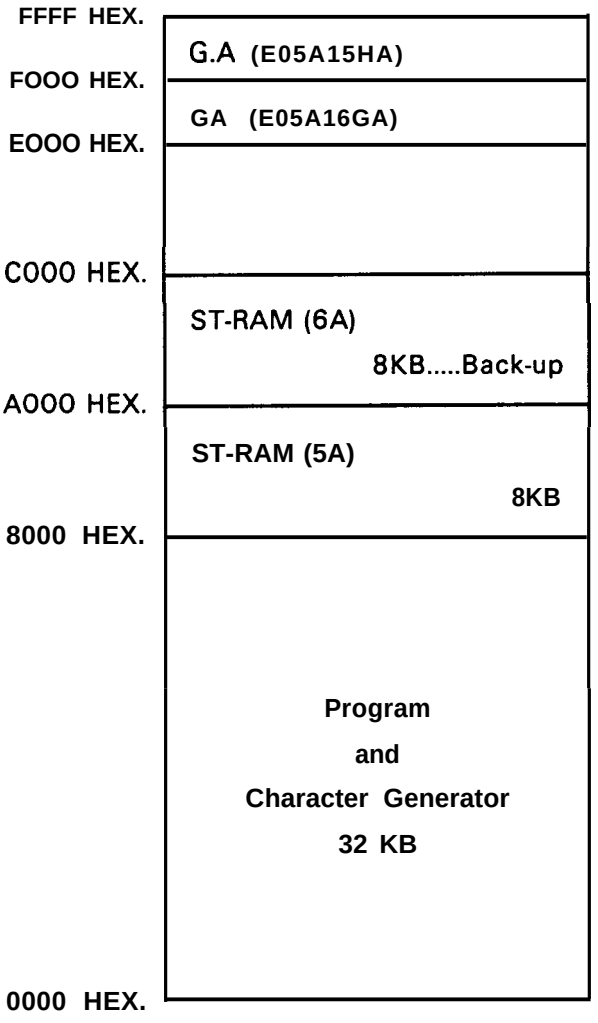


Figure 2-10. Memory Mapping

2.3.2 Power Supply Circuit

This section describes the operation of power supply circuit. The power supply circuit consists of following sections:

2.3.2.1 Filter Circuit

The AC line voltage passes through the power switch, then is input to the filter circuit. A fuse, F1, is used on the PEBFIL-II board. The filter circuit attenuates external noise and inhibits noise generated in the printer from going out via the AC line. Either C 1 or C2 drains leakage current between the primary coil and the case. Figure 2-1 1 shows the filter circuit.

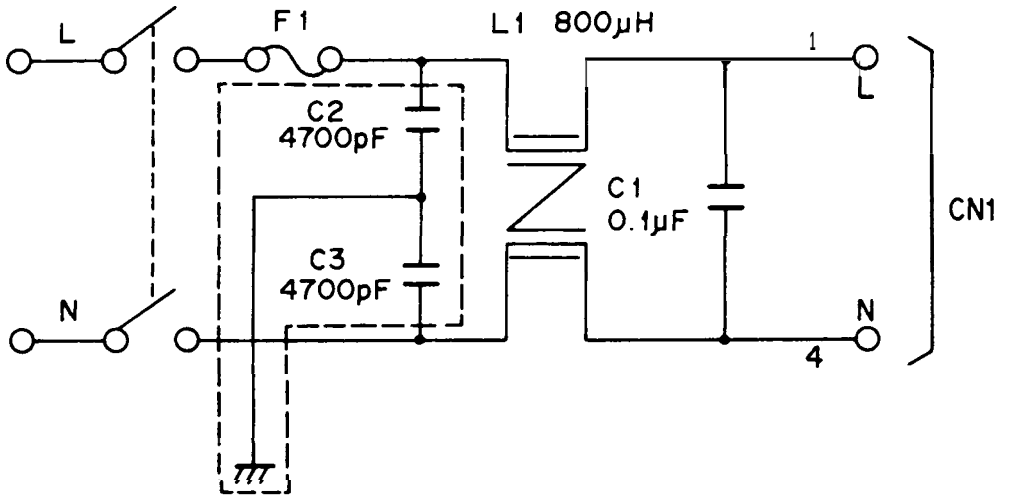


Figure 2-11. PEBFIL-II Filter Circuit Board

2.3.2.2 Transformer

AC Voltages(120 VAC, 220 VAC, 240 VAC) that pass through the filter circuit are divided into 26 VAC and 12 VAC and supplied to the PEGX circuit. Figure 2-12 shows a schematic drawing of the power transformer.

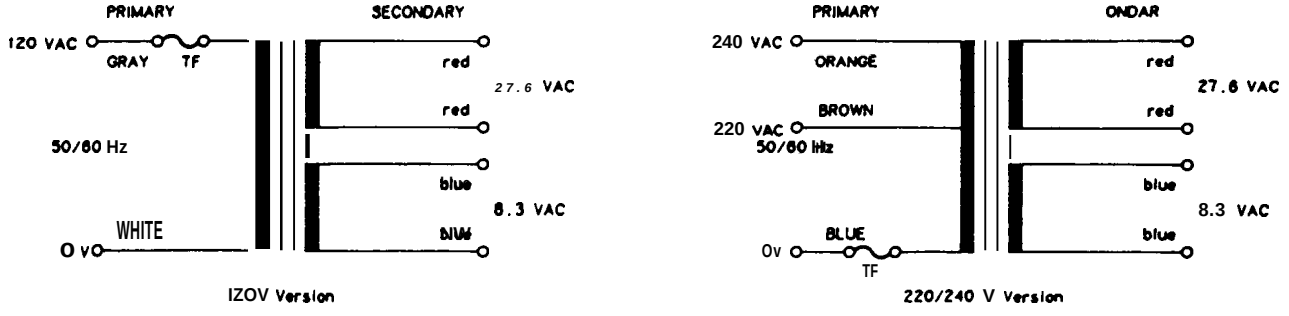


Figure 2-12 Transformer Circuit

2.3.2.3 Rectifier and Smoothing Circuit

The 26 VAC from the secondary coil of the transformer are full-wave rectified by diode bridge DB 1, and converted to approximately 36 VDC by smoothing capacitor C 1. The +24 VDC and + 5 VDC voltages are converted from this DC voltage, which is used as the power supply voltage for the switching regulator IC at the next stage.

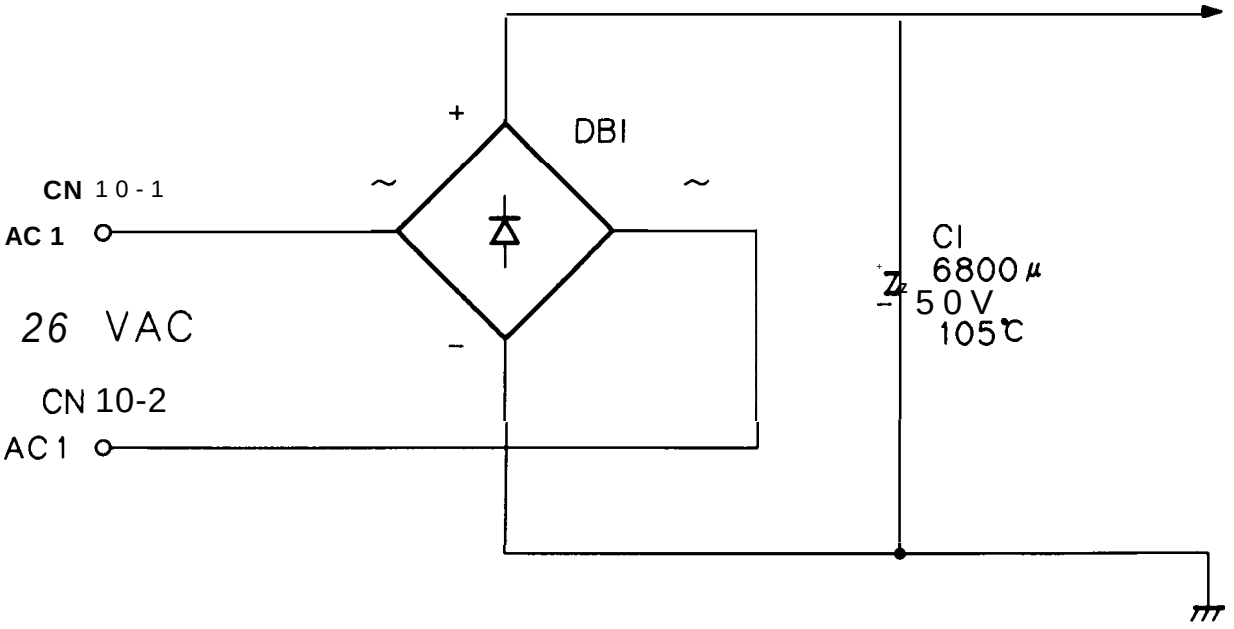


Figure 2-13. Rectifier and Smoothing Circuit

2.3.2.4 Chopper-Type Switching Regulator Circuit

A chopper-type switching regulator is employed in the power supply circuit. Operation of the step-down circuit is as follows:

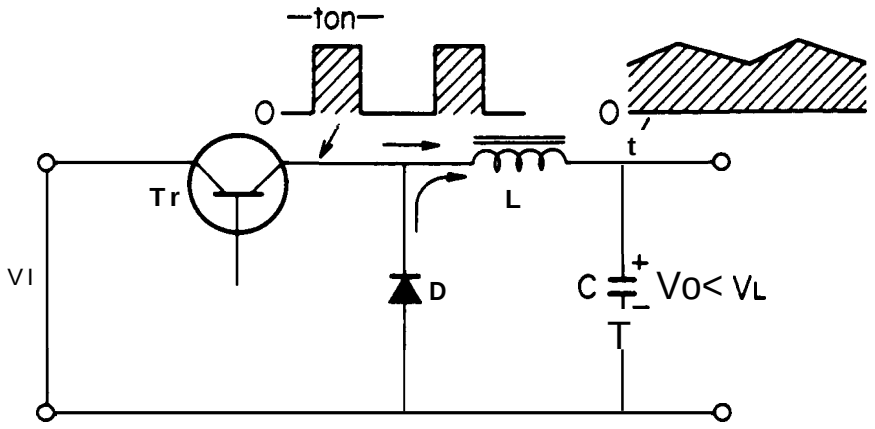


Figure 2-14. Step-Down Circuit

Figure 2-14 shows the chopper-type, step-down switching regulator circuit. When the transistor is ON, voltage Vi is applied to coil L and capacitor C, and load current IL flows. At this time, electromagnetic energy WL is accumulated in choke coil L. When the transistor turns off, WL is applied to the load via flywheel diode D so that output voltage Vo becomes the average value:

$$Vo = \frac{Vi \times Ton}{T}$$ **where, T = Ton + Toff (T is constant)**

Therefore, Vo can be held constant by controlling Ton. Figure 2-15 shows the step down timings.

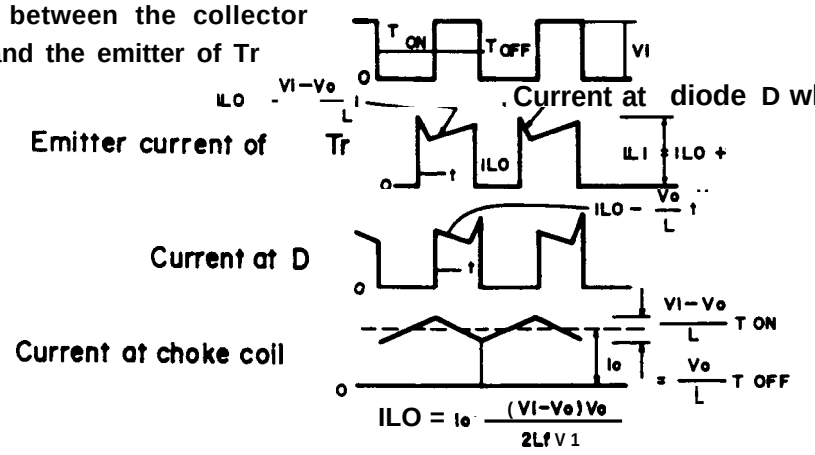


Figure 2-15. Step-Down Timings

2.3.2.5 Pulse-Width Modulation (PWM) Circuit

Figure 2-16 shows the internal circuit of the NJM2355 IC. The PWM comparator operates as follows:

In circuit 1 the output from AMP 1 flows into the negative terminal of comparator 1, and the outputs from AMP 2 and AMP 3 in circuit 2 flow into the negative terminal of PWM comparator 2 without wired OR. Dead-time control voltage is also input to additional negative terminals of both PWM comparators 1 and 2.

A sawtooth waveform from the oscillator is input to the positive terminals. The sawtooth waveform from the oscillator causes the comparators to generate pulses as shown in Figure 2-17.

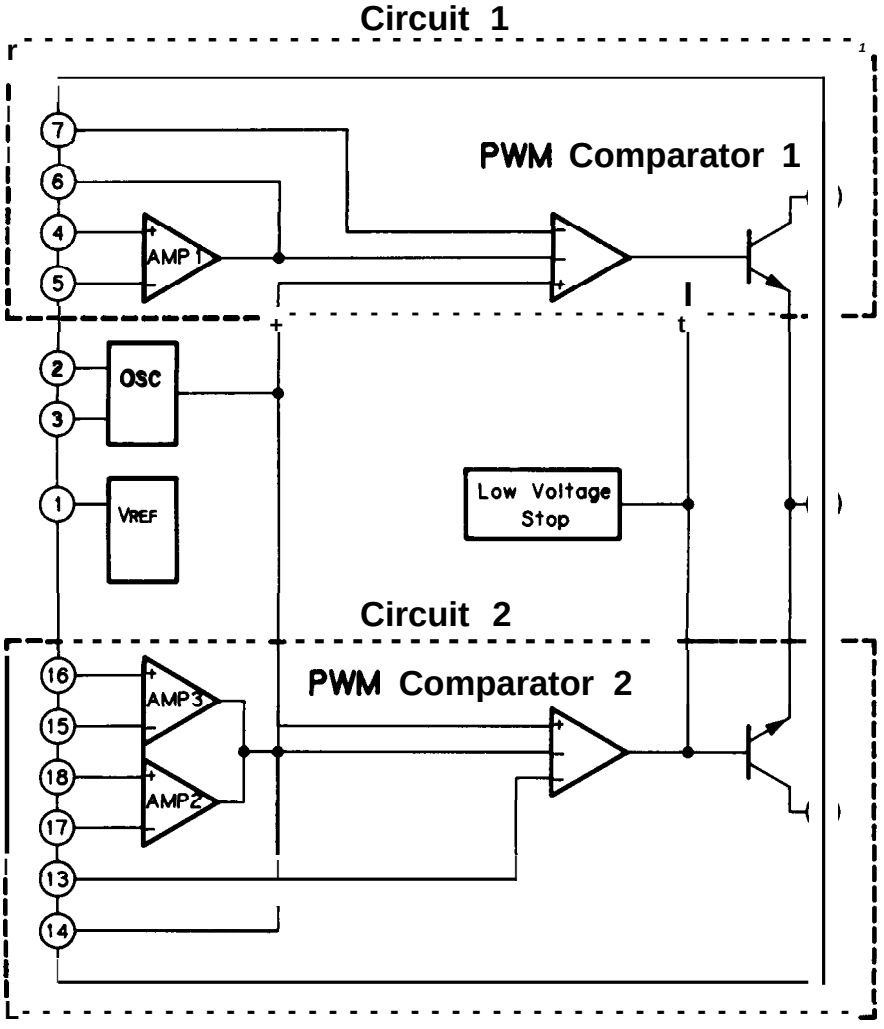


Figure 2-16, NJM2355 Internal Circuit

As shown in Figure 2-17, when the potential at the NJM2355 is lower than the preset voltage or current value, it is controlled by the dead-time control voltage. When it exceeds the preset value, it is controlled by the error amplifier to keep it lower than the preset value.

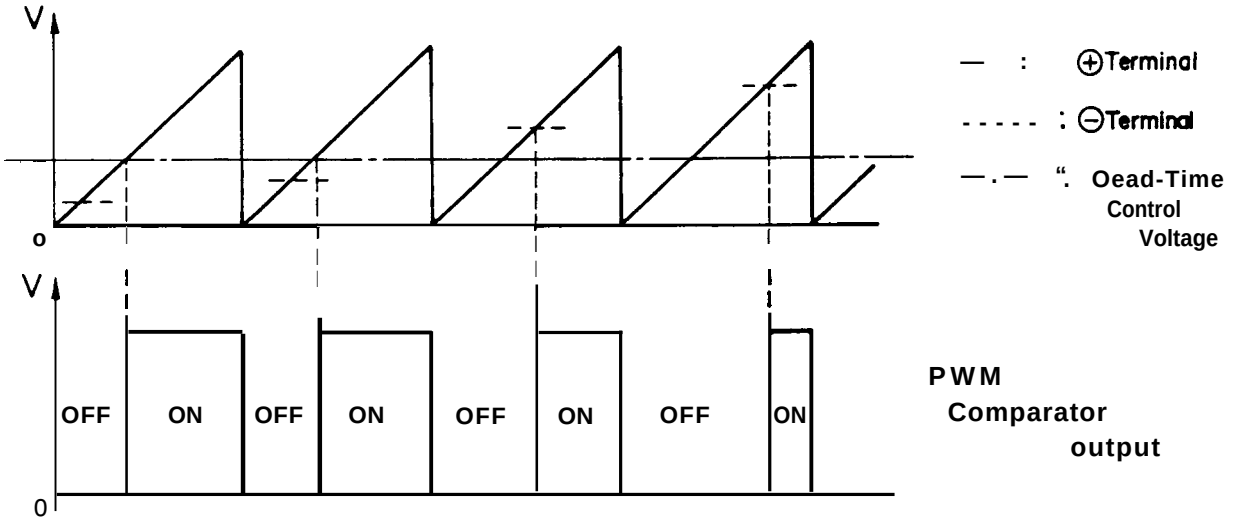


Figure 2-17. Output Transistor Drive Waveform

2.3.2.6 +5V Regulator Circuit

Figure 2-18 shows the +5 VDC regulator circuit An NJ M2355 switching regulator IC is used for constant-frequency pulse-width modulation. The circuit shown below employs an NJ M2355 configured as a chopper-style switching regulator circuit.

This IC has a built-in oscillator. The oscillation frequency is determined by external components connected to pins 2 and 3. Therefore, R22, and C9 cause the circuit to oscillate at about 30 kHz. The oscillator waveform is shown in Figure 2-19.

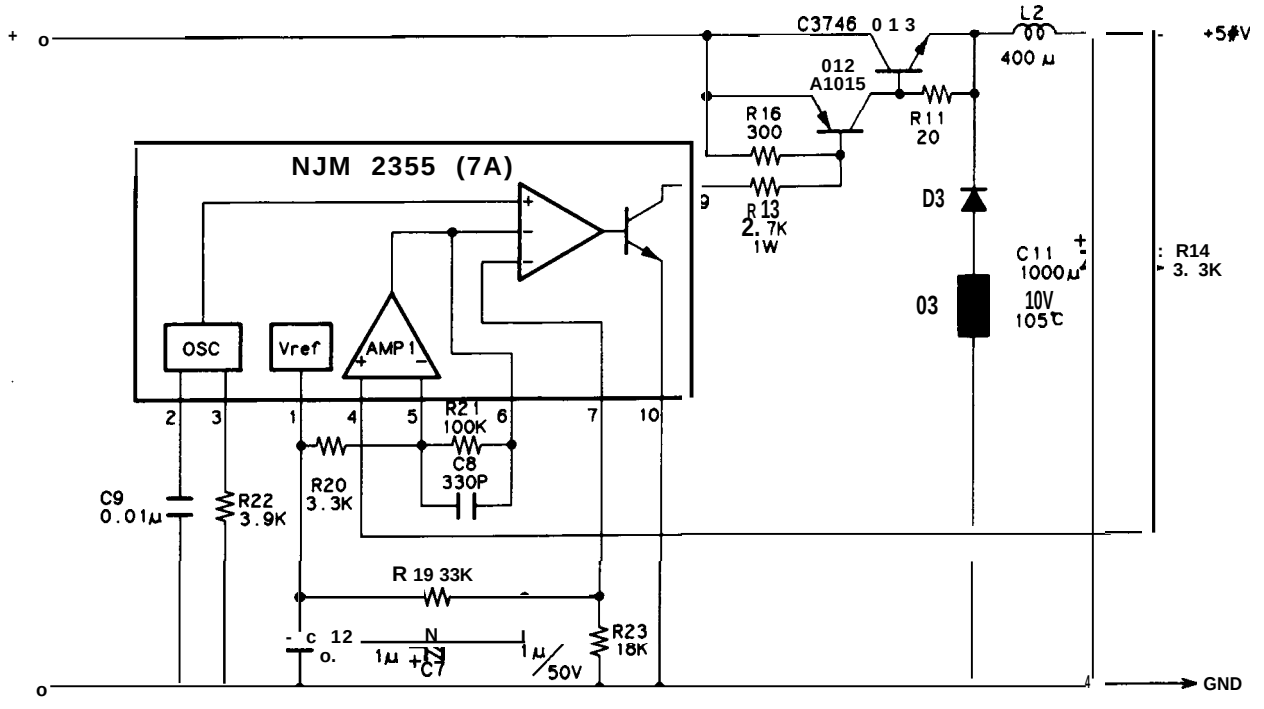
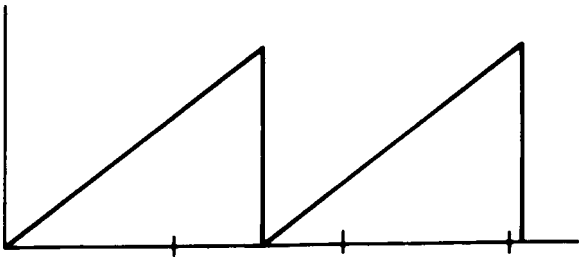


Figure 2-18. +5V Regulator Circuit



20µs/Div

Figure 2-19. Oscillator Waveform

AMP 1 in the IC is an error amplifier used to monitor the output voltage. Figure 20 shows the constant-voltage control circuit. Pin 1 of the IC provides a 5 V reference output (Vref), which is applied to the negative terminal of AMP 1.

The error amplifier adjusts its output according to the voltages applied to the positive and negative input terminals. This has the effect of maintaining the voltage at the terminal at 5V.

Figure 2-21 shows the output from AMP 1. When the voltage at pin 4 becomes higher than that at pin 5 (over voltage), AMP 1 outputs current modulated by pulse-width modulation (PWM) to reduce the output voltage of the circuit. PWM is described below.

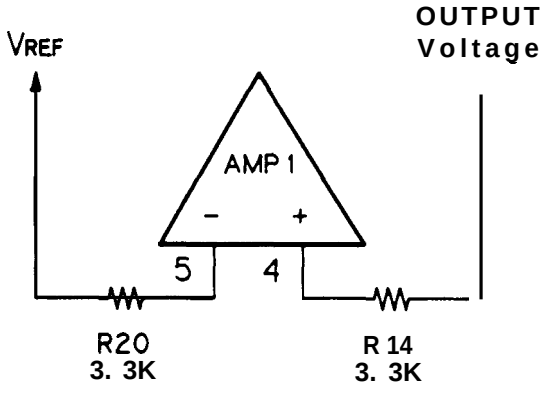


Figure 2-20. Constant-Voltage Control (+5 VDC)

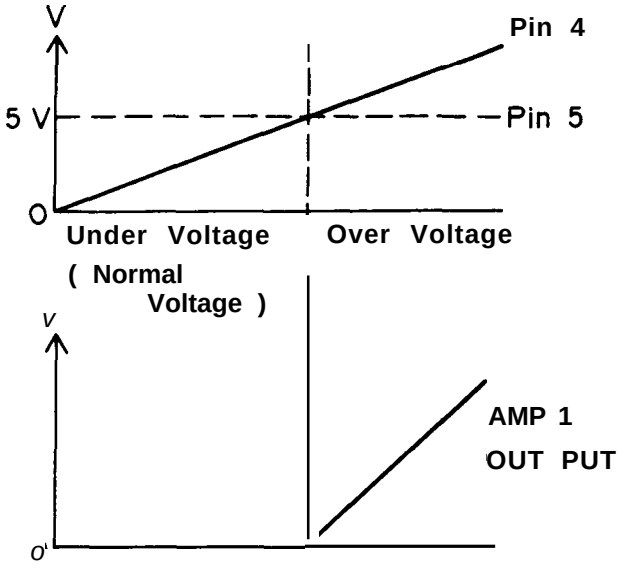


Figure 2-21. AMP 1 Output

R 108 and C35 compensate for phase lag in the error amplifier to prevent abnormal oscillation.

2.3.2.7 +24 VDC Regulator Circuit

Figure 2-22 shows the +24V regulator circuit.

The +24VDC regulator circuit has almost the same function and employs the same oscillation circuit as the + 5V VDC regulator circuit.

Here, the error amplifier AMP 2 is used for over-current control, and AMP 3 for constant-voltage control. The operation of the error amplifier AMP 3 is as follows.

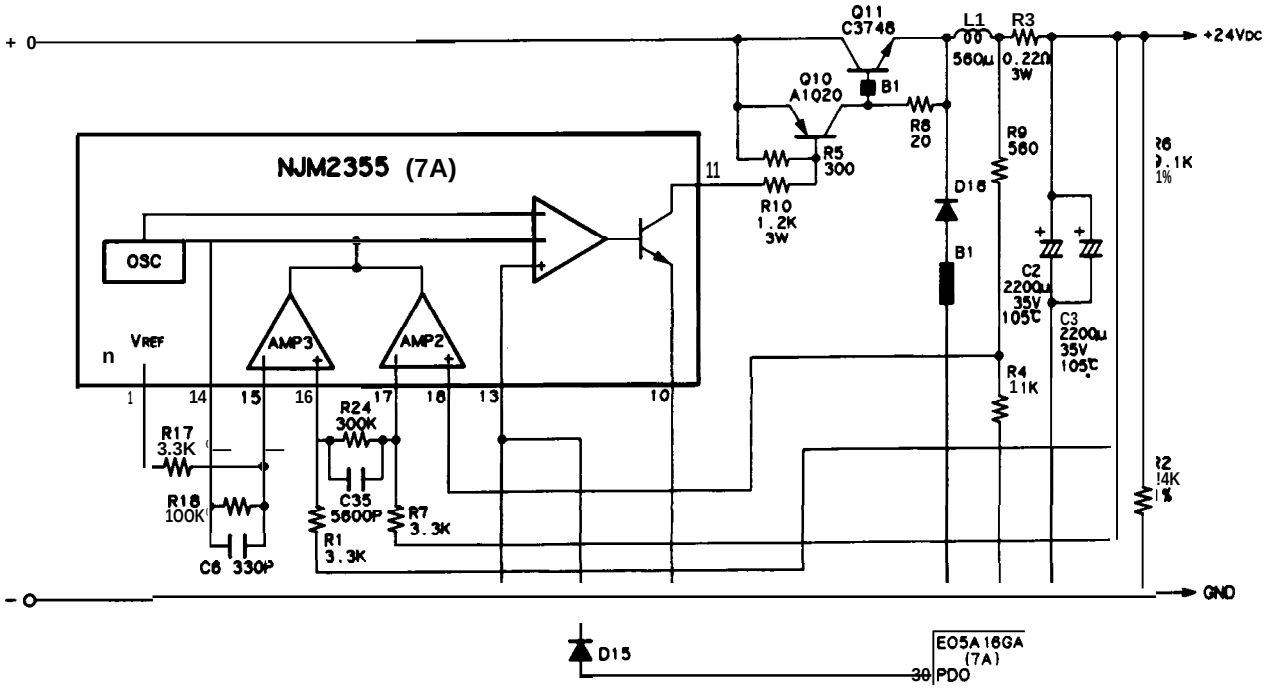


Figure 2-22. +24V Regulator Circuit

The negative terminal of AMP 3 receives V_{REF} (5V)
Consequently, the voltage applied to the positive terminal is adjusted to 5V. Therefore, based on Figure 2-23, the output voltage is set to the following value:

$$\frac{Vref}{R2}\ (R6 + R2) = \frac{5V}{2.4K}\ \text{ohms}\ (9.1\ \text{K ohms} + 2.4\text{K ohms})$$

$$= 23.96\ V$$

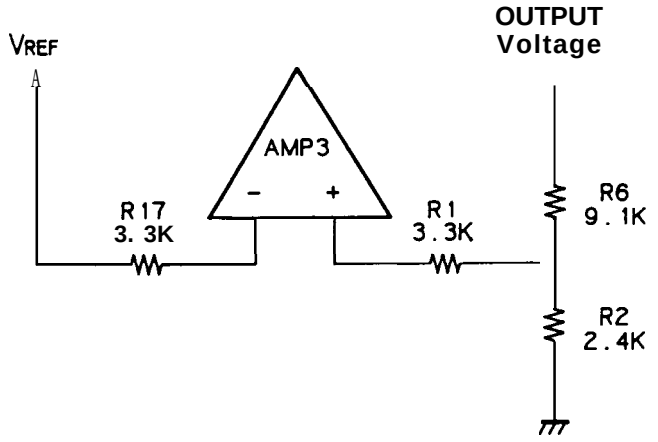


Figure 2-23. Constant-Voltage Control (+24 VDC)

AMP 2 operates as follows for over-current control.
+24 V is applied to the negative terminal, and the positive terminal will receive an equal voltage when, based on Figure 2-24, a negative current of the following value flows.

$$\frac{\text{Output Voltage}}{R4}\ R9/R3 = \frac{24V}{\text{'' K ohms}}\ 560\ \text{ohms}/0.22\ \text{ohms}$$

$$= 5.55\ [A]$$

If the current exceeds this value, over-current protection is turned on to reduce the output voltage.

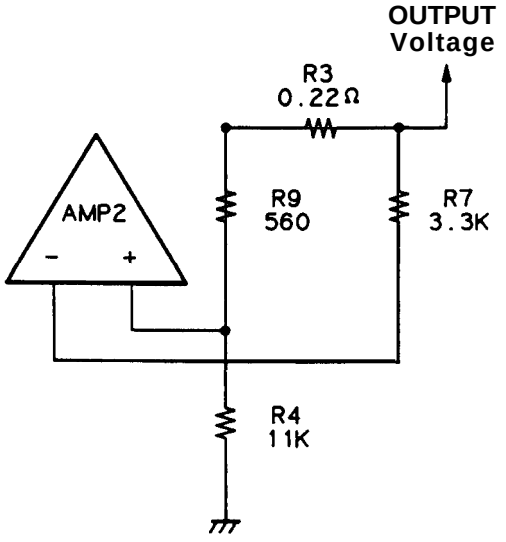


Figure 2-24. Over-Current Protection (OCP)

Dead-time control has no bearing in this case, because pin 3 of IC 1 1 is grounded.

2.3.2.8 +12 VDC Supply Circuit

The 12 VAC from the transformer is half-wave recrified by diode D7 and is converted to +12 VDC. As shown by Figure 2-25, the half-wave rectified voltages pass through the capacitor smoothing circuit so that the ripple is small, and the average DC voltage rises when no load current flows and drops as load current increases.

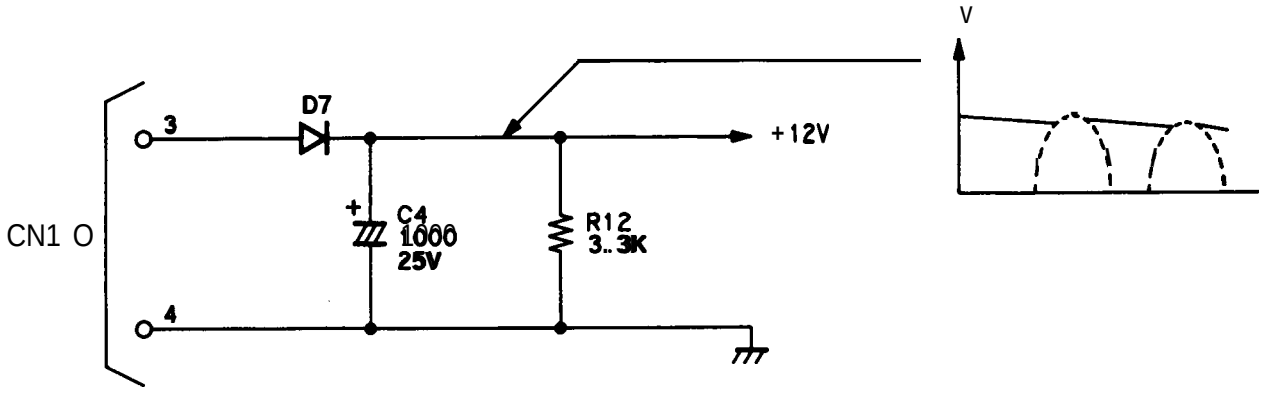


Figure 2-25. +12 VDC Circuit

2.3.2.9 Vx Voltage Supply Circuit

When the +24V power supply line reaches 18.6 V (18 V + 0.6 V), transistors Q30 and Q23 turn on and Vx (+5 V) is output. On the other hand, if the + 24V power supply line drops to 18.6 V or less, Q30 and Q23 turn off and the Vx voltage is shut off.

● **Reset Circuit Power Supply**

When the power is switched on or off, the circuit is reset so that it will not drive the printer until the power supply becomes stable.

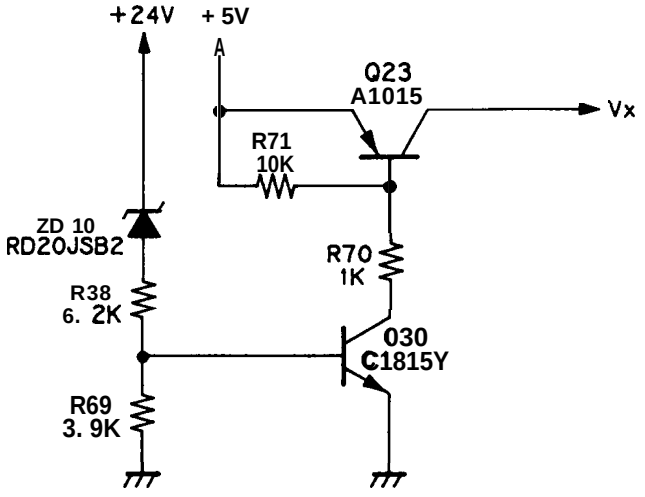


Figure 2-26. Vx Voltage Circuit

2.3.3 *Main* IC *Functions*

This section describes the functions of the main ICS in the PEGX board control circuit.

2.3.3.1 CPU Functions

The printer employs the μPD78 10HG CPU. The CPU processes data using a 3.685 MHz clock which is 1/4 of the external clock (14.74 MHz.)

The CPU is reset when the reset signal (pin 28: LOW) is input, and executes the external program (4A, PROM) from address O.

The CPU controls all of the printer operations either directly or indirectly. The external memory area is expanded to 64K bytes so that the CPU can control the internal RAM, external ROM (4A: program and character generator), external SRAMS (5A and 6A), and the E05A16G and E05A15A gate arrays (7A and 3A).

NOTE: Refer to Section 2.3.1.3 for memory mapping.

This CPU includes an 8-bit analog-to-digital converter, timer-event counter, and serial interface. These functions can be set in units of bits using the mode register for each port, and are used with general I/O ports (excluding the analog-to-digital converter.)
Table 2-3 shows the port assignments. (Refer to the Appendix for details on the CPU.)

Table 2-3. Pin Function **of** *CPU*

Pin No.	Signal Name	Direction	Function
1 | 6	PA0 | PA5	—	Not used.
7	PA6	IN	AUTO FEED XT signal/DIP switch 2-4
8	PA7	IN	SLCT IN signal/Jumper J 1
9 | 16	PB0 | PB7	IN	DIP switch 1-1 to 1-8
17	PC0	OUT	TXD data output
18	PC1	IN	RXD data input
19	PC2	—	Not used
20	PC3	IN	ON-LINE switch interrupt input
21	PC4	—	Not used
22	PC5	IN	P/S (Parallel/Serial) data transfer selection signal input
23	PC6	OUT	PWD signal output
24	PC7	OUT	Paper feed motor driving control output
25	NM 1	—	Not used

Table 2-3. Pin Function of CPU (cent'd)

Pin No.	Signal Name	Direction	Function
26	INT1	—	Not used
27	MODE1	—	External mode setting terminal
28	RESET	IN	External reset signal
29	MODE0	—	External mode setting terminal
30	x2	—	Oscillator terminal. FX-850/1050 : 14.74 MHz
31	x I		
32	Vss	—	Ground
33	AVss	—	Analog port ground
34	AN0	IN	Vp (+ 24VDC) monitor port
35	AN 1	IN	Vu (+36VDC) monitor port
36	AN2	IN	Printhead short-circuit monitor port
37 | 39	AN3 | AN5	IN	DIP switch 2-1 to 2-3
40	AN6	—	Not used
41	AN7		
42	VAref	IN	Analog reference voltage input : 4.7V
43	AVcc	—	Analog port power source
44	RD	OUT	Read strobe signal output
45	WR	OUT	Write strobe signal output
46	ALE	OUT	Address Latch Enable signal output (Low address : AO -A8)
47 | 54	PF0 | PF7	OUT	High address data (A8 -Al 5)
55 | 62	PD0 | PD7	IN/OUT	8 bit address/data bus
63	VDD	—	Internal memory power source
64	Vcc	—	Main power sourse

NOTE: "Direction" on the signal flow is as viewed from the CPU.

2.3.3.2 E05A15HA Gate Array Functions

This gate array performs chip selection for the main components on the PEGX board, under the control of the 78 10HG CPU. The gate array also outputs the lower address signals (AO through A7) for the ROM and RAM using data from the CPU. In addition, the gate array controls the carriage motor and paper feed motor, and drives the printhead and plunger solenoids.

Table 2-4 shows the pin assignments for the gate array. Refer to the Appendix for the details on the gate array.

Table 2-4. Pin Function of GA (E05A15HA)

Pin No.	Signal Name	Direction	Function
1 2	BANK O BANK 1	OUT OUT	Not used
3	CS4	OUT	Chip select signal for the gate array (7A): Low active signal
4	CS3	OUT	Chip select signal for the ST-RAM (6A): Low active signal
5	CS2	OUT	Chip select signal for the ST-RAM (5A): Low active signal
6	Cs 1	OUT	Chip select signal for the P-RAM (4A): Low active signal
7	P4		Not used
8	P3	IN	Home Position (HP) signal input
9	P2	IN	Paper End (PE) signal input
10	P1	IN	Friction/Tractor switch status input Friction mode: High Tractor mode: Low
11	Po	IN	Not used
12 13 14 15	CRA CRB CRC CRD	OUT OUT OUT OUT	Carriage motor driving signal
16 I 23	HD 1 I HD8	OUT OUT	Printed driving signal (Head Data 1-8)
24 25	Vss Vss	—	Logic Ground

Table 2-4. Pin Function of GA (E05A15HA) (cent'd)

Pin No.	Signal Name	Direction	Function
26	PWD	IN	Printhead driving signal
27 28 29 30	PFA PFB PFC PFD	OUT OUT OUT OUT	Paper feed motor driving signal
31	CTRGO	—	Not used
32	VDD	—	+5V
33	P5	OUT	Plunger solenoid driving signal
34	WR	IN	Write strobe signal
35	$\overline{RD}$	IN	Read strobe signal
36	A13R	OUT	Address bit Al 3 for the P-ROM (4A)
37	Al 4R	OUT	Address bit Al 4 for the P-ROM (4A)
38	HD9	OUT	Printhead driving signal (Head Data 9)
39 40 41 42	A12 Al 3 Al 4 Al 5	IN IN IN IN	Address bit Al 2-Al 5 (input)
43 44 45	AO A I A2	OUT OUT OUT	Address bit AO-A2 (output)
46	CTRG−	IN	Not used
47	$\overline{RST}$	IN	Reset signal input
48	Vss		Logic Ground
49	ALE	IN	Address Latch Enable
50	CTRG+	IN	Not used
51 | 55	A3 | A7	OUT | OUT	Address bit A3-A7 (output)
56 | 63	DO | D7	I/O | I/O	Input/Output data bus: DO - D7
64	VDD	—	+5V

NOTE: "Direction" on the signal flow is as viewed from the gate array.

2.3.3.3 E05A16GA Gate Array Functions

The E05A16GA gate array is selected by the CS signal (pin 37: decoded by the higher address in the E05A 15HA) from the E05A15HA gate array (3A), and the internal function of this gate array is activated when the CPU reads or writes data at the memory mapped address (lower address: AO through A3).

Table 2-5 shows the pin assignments for this gate array. Refer to the Appendix for the detailed specifications on this gate array.

Table *2-5. Pin Function of GA* **(E05A16GA)**

Pin No.	Signal Name	Direction	Function
1 | 4	D4 | D7	IN/OUT	Data bus bit 4-7
5	RXDIN	IN	Not used
6	RSTIN1	IN	Initialize signal (IN IT) input: Low active signal
7	Vss	—	Logic ground
8	RSTIN2	IN	Power-on reset signal
9 | 14	IN7 | IN2	IN	Parallel data (D7-D2)
15	STRB	IN	Strobe signal
17 | 18	IN1 | INO	IN	Parallel data (D1-DO)
19	RSTOUT	OUT	Reset signal output which the RSTIN1 or RSTIN2 signal is input.
20	BUSY	OUT	BUSY signal
21	ACK	OUT	Acknowledge signal
22	PE	OUT	Paper End signal
23	ERR	OUT	ERROR signal
24	PC3	OUT	Carriage motor control signal
25	PC2	OUT	Buzzer control signal
26	Pc 1	OUT	Plunger solenoid ON/OFF control signal
27	PCO	OUT	Carriage motor control signal
28	RXDOUT	OUT	RXD Signal output
29	PD 1	OUT	Carriage motor Power-down signal
30	PDO	OUT	+ 24V DC control signal
31	PAO	IN	FONT switch (control panel) status monitor
32	VDD	IN	Power source
33	PA1	IN	PITCH switch (control panel) status monitor
34	PA2	IN	CONDENSED switch (control panel) status monitor
35	Vss	—	Logic ground

Table 2-5. Pin Function of GA (E05A16GA) (cent'd)

Pin No.	Signal Name	Direction	Function
36	PC4	OUT	PAPER OUT LED ON/OFF Control Signal
37	PC5	OUT	READY LED ON\ OFF control signal
38	PC6	OUT	ON LINE LED ON/OFF control signal
39	PC7	—	Not used
40	PBO	OUT	DRAFT LED ON/OFF control signal
41	PB1	OUT	ROMAN LED ON/OFF control signal
42	PB2	OUT	SANS SERIF LED ON/OFF control signal
43	PB3	OUT	10 CPI (PICA) LED ON/OFF control signal
44	PB4	OUT	12 CPI (ELITE) LED ON/OFF control signal
45	PB5	OUT	PS (PROPORTIONAL) LED ON/OFF control signal
46	PB6	OUT	CONDENSED LED ON/OFF control signal
47	PB7	—	Not used
48	Vss	—	Logic ground
49	PA3	IN	LINE FEED switch
50	PA4	IN	FORM FEED switch
51	PA5	IN	LOAD/EJECT switch
5 2 53	PA6 PA7	—	Not used
54 | 56	AO | A2	IN	Address bit (AO - A2)
57	Cs	IN	Chip Select signal input
58	RD	IN	Read strobe signal
59	WR	IN	Write strobe signal
55 | 63	DBO | DB3	IN/OUT	Input/Output data bus (DO - D3)
64	VDD	IN	Power source

NOTE: "Direction" on the signal flow is as viewed from the gate array.

2.3.4 *Main Circuit Operation*

All the printer operations are controlled by the PEGX board. The printer control can be divided into two sections: the main control for the host computer interface, printer initialization, memory control, analog signal detection, and reading the DIP switch settings, and error detection and mechanism control for driving the printer mechanisms such as the carriage motor, paper feed motor, plunger, and printhead. This section describes the operation of the following:

- **Reset Circuit**
- **Interface Control Circuit**
- **Memory Back-up Circuit**
- **Error-Detection**

2.3.4.1 Reset Circuit

The printer is reset when any of the following occur:

- **The printer power is turned on (hardware initialization).**
- **The initialization signal (INIT) is received from the host computer (hardware initialization).**
- **Control code ESC@ is received from the host computer (software initialization).**

The reset operation performed for the ESC@ code is different from that for the other two cases. Figure 2-27 shows the reset circuit.

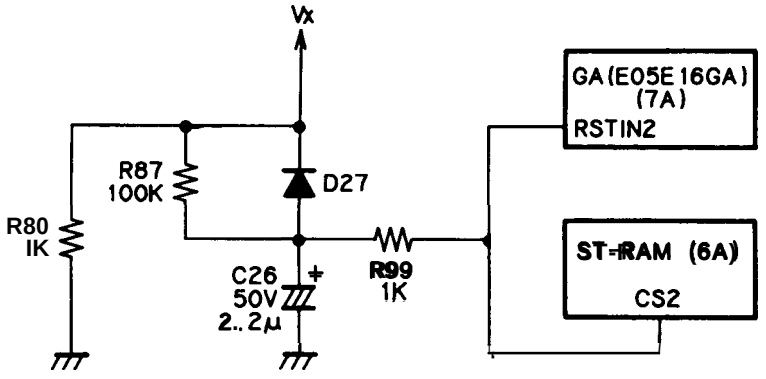


Figure 2-27. Reset Circuit

Refer to Section 1.7 for information on hardware and software initialization.

2.3.4.2 Interface Control Circuit

Parallel data communication between the printer and host computer is controlled by the gate array (IC7A:E05A 16GA) on the PEGX board. Figure 2-28 shows the interface control circuit block diagram. Figure 2-29 shows the parallel interface data transmission timing.

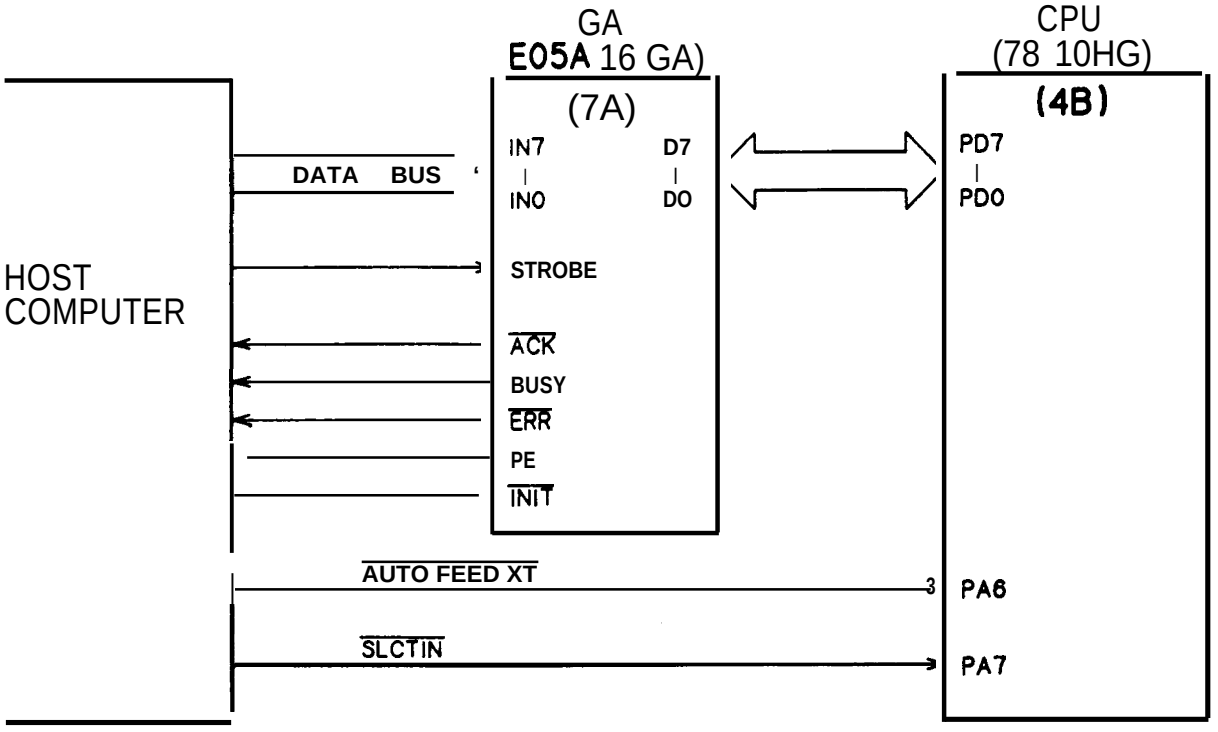


Figure 2-28. Interface Control Circuit Block Diagram

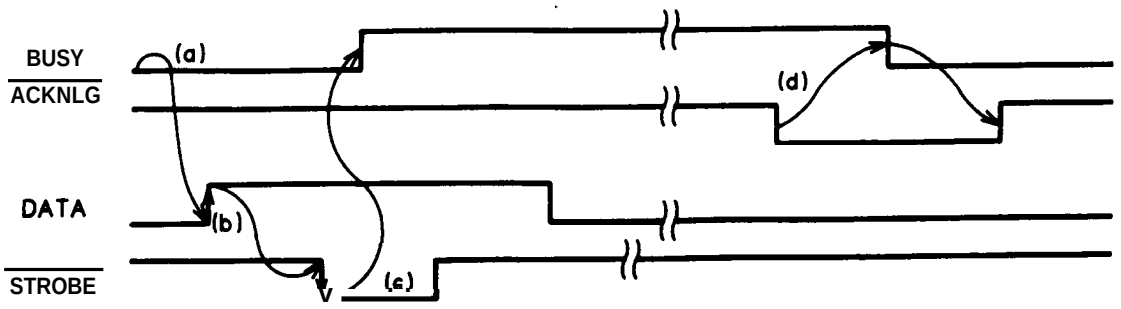


Figure 2-29. Data Transmission Timing

Sequence

1. **Data transmitted from the host computer is latched into the gate array at the trailing edge of the $\overline{\text{STROBE}}$ signal. The gate array (IC7A) then outputs the BUSY signal to the host computer.**
2. **The CPU reads the data latched in the gate array and clears the BUSY signal. However, the CPU also outputs a software generated BUSY signal to the host computer via the gate array (IC7A) so that the BUSY signal to the host computer remains HIGH.**
3. **The CPU stores the data from the gate array (IC7A) in the input buffer (IC5A) and informs the gate array of completion of data processing through the data bus. The gate array outputs the ACK signal to the host computer to indicate that 1 byte of data has been processed. The CPU then clears the BUSY signal.**
4. **The printer is now ready to accept the next data byte.**

Serial Interface Control Circuit

Serial data communication between the printer and host computer is controlled by the serial interface board (#8 143). Other buffered serial interface boards are available.

Figure 2-30 shows the serial data flow.

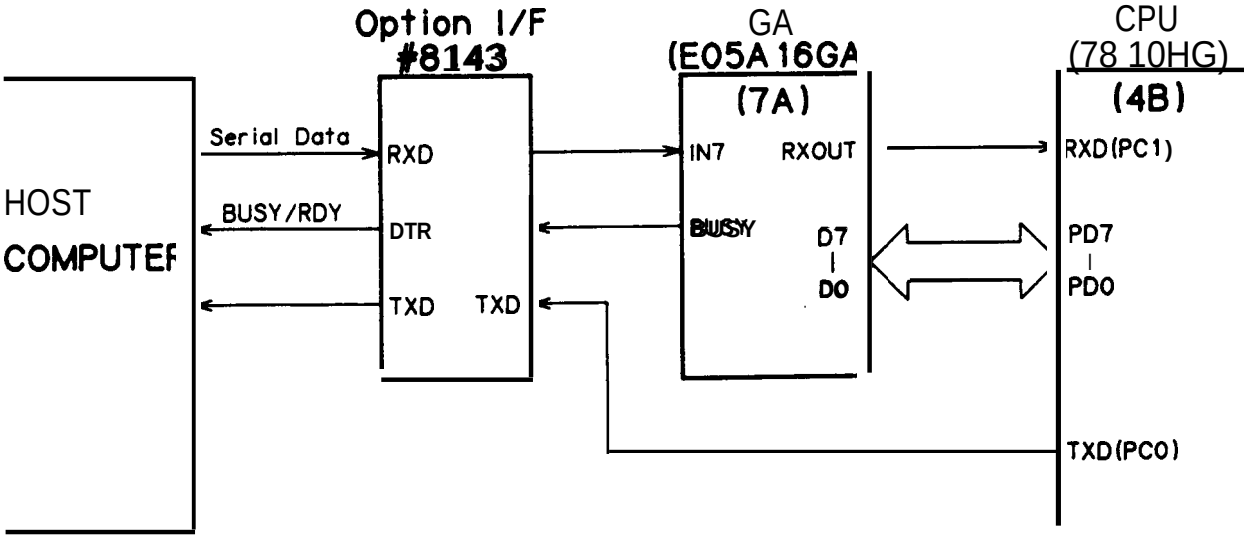


Figure 2-30. Serial Data Flow

Sequence

1. **Serial data from the host computer is input to terminal IN7 of the gate array via the optional interface (8 143) using a start-stop system. The serial data is input in order of the start bit, data (7 or 8 bits), and stop bits. While a byte of data is being processed, the printer is kept in the BUSY state.**
2. **The data input into the gate array is serially transferred from the RXOUT terminal to the RXD terminal of the printer.**
3. **The byte of serial data input to the CPU is converted from serial to parallel in the CPU and stored in the input buffer. The BUSY state is cleared.**
4. **The printer is ready to accept the next data byte.**

2.3.4.3 DIP Switch Circuit and Jumpers

The printer has two types of DIP switches and two jumpers. Figure 2-31 shows the DIP switch circuit.

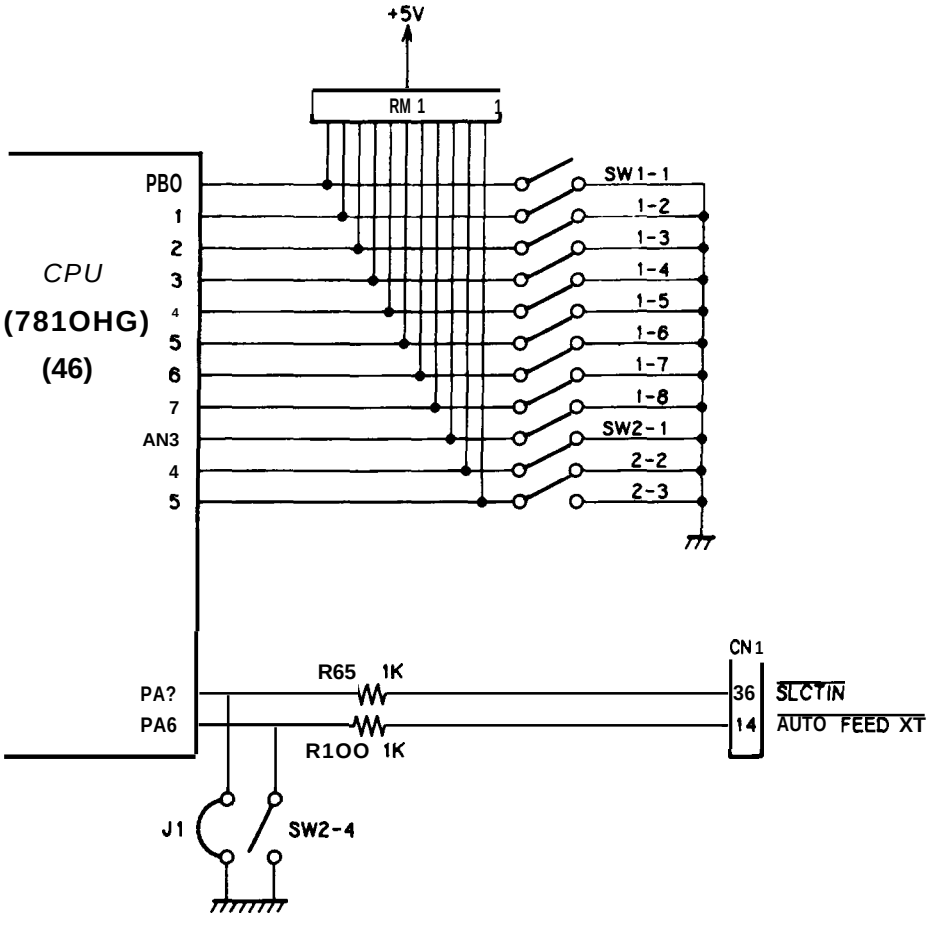


Figure 2-31. DIP Switch Circuit

DIP switch settings are read by the DIP switch circuit whenever the printer power is turned on and whenever the INIT signal is sent to the printer from the host computer.

Jumpers

There are two jumpers on the PEGX board.

J 1: Determines whether or not the internally fixed printer selection signal (SLCTIN) is selected by the host computer.

When jumper J 1 is connected, the $\overline{\text{SLCTIN}}$ signal is internally fixed (always selected).

J2: Switches the memory capacity (5 12K bits or 256K bits) for the PROM (IC4A).

2.3.4.4 Memory Back-up Circuit

The printer is equipped with SRAM (IC6A) that stores the printing mode, character pitch, and TOF (top of form) position set using the control panel. The memory back-up circuit is on the PEGX board so that the settings can be maintained even when the printer power is turned off. A lithium battery is used to back up the memory. Figure 2-32 shows the memory back-up circuit.

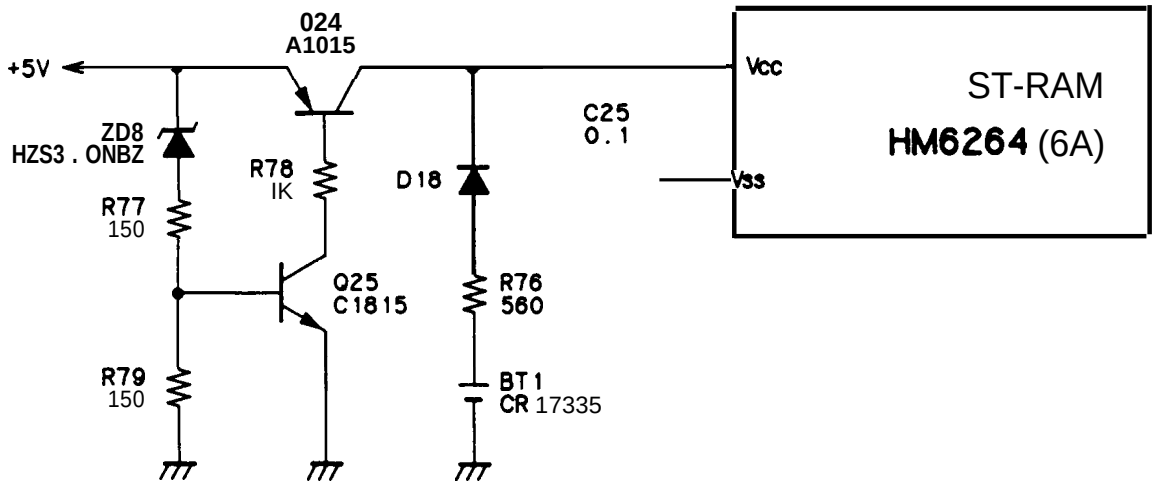


Figure 2-32. Memory Back-up Circuit

When the power is turned on under normal conditions, +5V is applied to Vcc of the RAM and the CPU starts reading and writing. When the power is turned off, and the voltage on the + 5V line decreases to about 3.0V, transistors Q24 and Q25 are switched off and the voltage from the external lithium battery is applied to the Vcc terminal. The data in the static RAM is therefore maintained. Table 2-6 lists the static RAM conditions when the power is on or off.

Table 2-6. ST-RAM Conditions

Power	+5V Line	CS2	Vcc [v]	ST-RAM mode
OFF	L	L	+3.0 - 3.3	Data holding
ON	H	H	+ 5	Normal

2.3.4.5 **Printer Error Detection**

The printer has a function that detects various errors and informs the user of the type of error using buzzer sound patterns. If an error occurs, the printer is set OFF LINE and the drive voltage is cut off so that damage to the circuits can be minimized. Types of errors, descriptions, and printer states are as follows:

- **Carriage Errors:**

  The buzzer beeps 6 times, pausing briefly after third beep.

  Error status:

  - **The home position sensor indicates home position when the carriage cannot be at the home position.**
  - **The home position sensor does not indicate home position when the carriage must be at the home position.**
  - **Printing has not been completed when the carriage is in the deceleration mode.**
  - **After a home position seek is executed, the carriage does not return to the home position.**
  - **Printing is not completed after the carriage reaches the home position.**

- **Abnormal Voltage**

  The buzzer beeps 5 times with a pause after every beep.

  - **An abnormal voltage has been detected on the 24 VDC line. The +24 V (VP) is monitored at ANO of the CPU. If the voltage (+25 V) is + 28.4 V or more or 19.6 V or less, the printer enters an error state.**

- **Shorted Printhead Drive Transistor**

  The buzzer beeps 10 times with a pause after every beep.

  - **When the printer power is turned on, the drive transistor is checked for shorts during the printer initialization sequence.**
  - **During printing, the printhead drive circuit is checked for shorts each time printing of one frame is completed.**

  The state of the printhead drive transistor is monitored at AN 1 (pin 35) of the CPU.

- **RAM error**

  The buzzer beeps 6 to 10 times, pausing briefly after every 2 beeps. The beeps warns which RAM is incorrect as follows:

  Beeps 6 times: internal CPU

  Beeps 8 times: ST-RAM (5A)

  Beeps 10 times: ST-RAM (6A)

  There are three RAMs on the PEGX board, a 256-byte RAM in the CPU and static RAMs IC5A and IC6A. When the printer power is turned on, read/write tests of the RAM in the CPU and SRAMIC5A are performed, and a check sum of the IC6A back-up SRAM is calculated and checked.

  When any of the above four errors (carriage error, abnormal voltage, shorted printhead drive transistor, or RAM error) is detected, the printer is set OFF LINE, and the following process is performed:

  - **Prohibit interrupt**
  - **Initialize 1/0 port**
  - **Initialize printhead data**
  - **Drop + 24VDC and + 36VDC**
  - **BUSY signal goes high.**
  - **ERR signal goes low.**
  - **Buzzer beeps.**

● **Paper End Error**

The buzzer beeps 20 times with a pause after every four beeps.

• No paper was loaded when the printer power was turned on.

*** The paper-out state was detected during printing (paper feeding).**

When the paper-out state is detected, the printer is set OFF LINE, and the following process is performed:

- **PE signal goes high.**
- **PE LED lights**
- **Buzzer beeps.**

2.3.5 Printer Mechanism Control

This section describes following operating principles:

. Carriage Control Circuit and Software Control

● Paper Feed Control Circuit and Software Control

● Print Control Circuit

2.3.5.1 Carriage Control Circuit

The carriage mechanism of the printer is driven by the carriage motor. Reversing the motor rotation, holding, and phase switching for the carriage motor are controlled by the 4-phase stepper motor drive IC (IC2A: STK6722HZ). This IC (IC2A) is controlled by a gate array (IC3A: E05A15HA) which is controlled by the CPU. The rotational speed of the carriage motor is controlled by another gate array (IC3A: E05A16GA). This gate array (IC7A) also outputs the power-down signal (PD 1) that shuts off carriage motor drive voltage Vu when a hardware error is detected. Figure 2-33 shows the block diagram of the carriage motor control circuit.

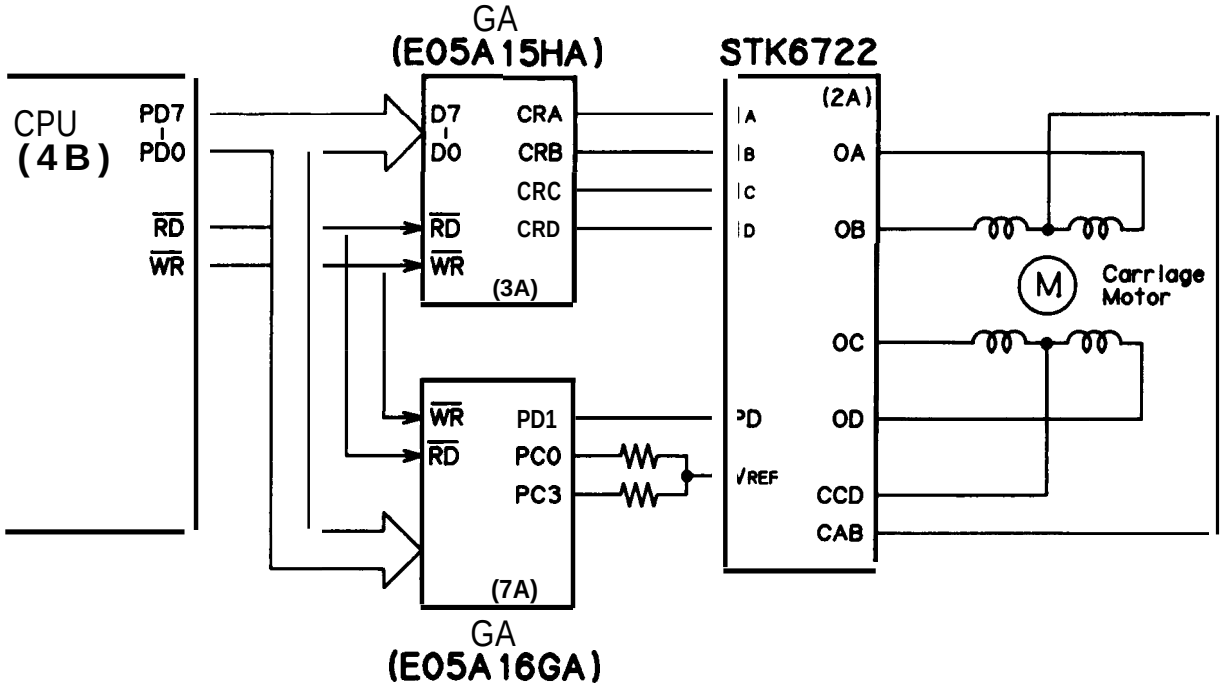


Figure 2-33. Carriage Motor Control Block Diagram

Carriage Motor Specifications

Type	**4-phase 200-pole stepper motor**
Voltage	**Driving: +36DC**
	Holding: +5V DC
Coil Resistance	**110 ±7% at 25°C per phase**
Current	**Driving: 0.68A (max.)**
	Hoding: O. 15A (typical)
Excitation	**1-2 phase, 2-2 phase**

* **Gate Array (IC3A: E05A15HA)**

This gate array (IC3A) outputs the phase-switching signals (CRA, CRB, CRC, and CRD) to the 4-phase stepper motor drive IC (IC2A: STK6722HZ), under the control of the CPU. Phase-switching cycles and timing vary depending on the speed and the mode (forward or reverse) of the carriage.

The mode register in the gate array (IC3A) determines the carriage movement direction and phase switching method, and is fed by the CPU. The gate array (IC3A) expands the phase data (PD0 - PD3) from the CPU in the carriage motor phase-switching circuit in accordance with the direction and method determined by the mode register, and outputs the data to the 4-phase stepper motor drive IC (IC2A). Figure 2-34 shows the block diagram of the gate array (IC3A) operation.

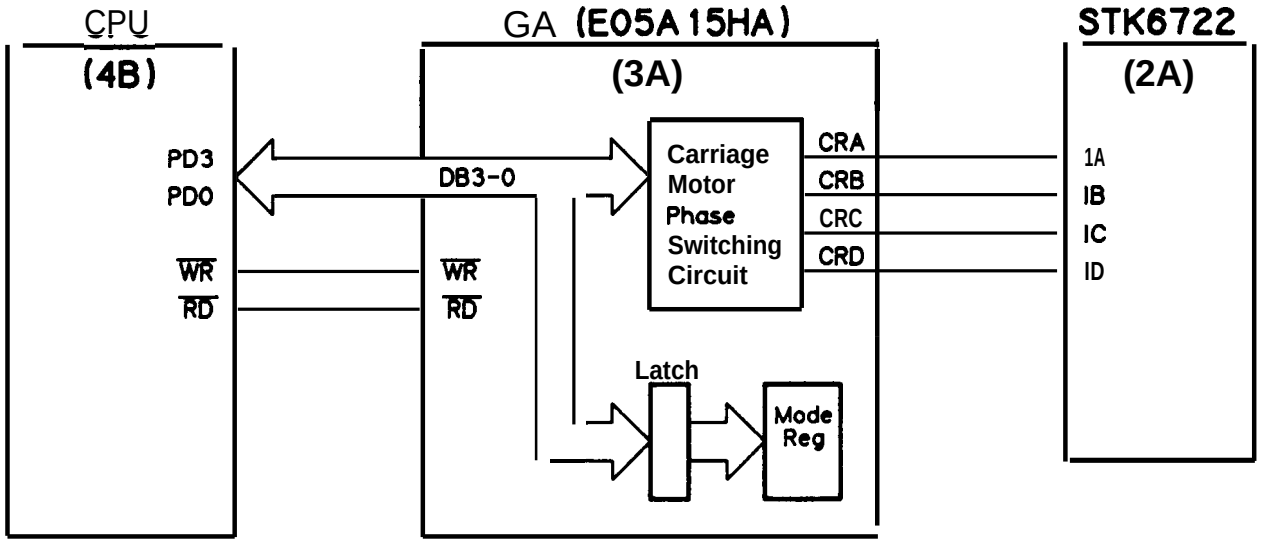


Figure 2-34. GA (E05A15HA) Operation Diagram

* **Gate Array (IC7A: E05A16GA)**

This gate array (IC7A) outputs the carriage speed control signal (PC0 and PC3) to the 4-phase stepper motor drive IC (IC2A: STK6722HZ), under the control of the CPU. The carriage speed is controlled by combining the reference voltage for the 4-phase stepper motor drive IC (IC2A) with PC0 and PC3. Figure 2-35 shows the block diagram of the gate array (IC7A) operation.

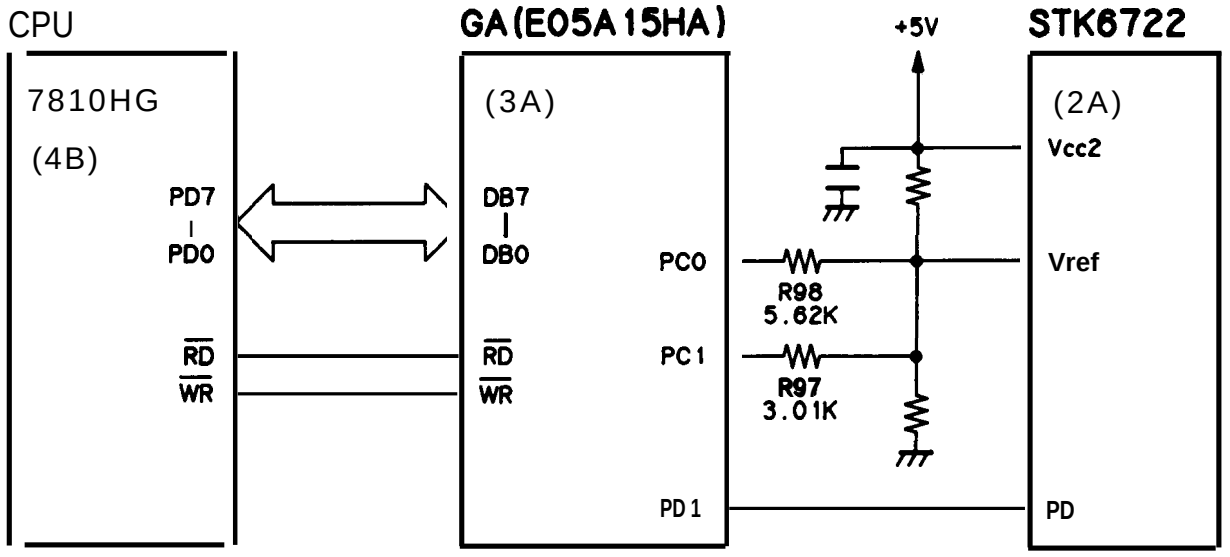


Figure 2-35. *GA (E05A16GA) Operation Diagram*

This gate array also performs another function. When a hardware error (except a paper end) is detected in the printer, the gate array outputs the power down signal (PD 1) to the 4-phase stepper motor drive IC (IC2A) and shuts off the +36 VDC, so that damage to the circuit can be minimized.

- **4-phase Stepper Motor Drive IC(IC2A: STK6722HZ)**

  The 4-phase stepper motor drive IC directly drives the carriage motor, under control of the gate arrays (IC3A: E05A15HA and IC7A: E05A16GA). Figure 2-36 shows the carriage motor drive circuit block diagram.

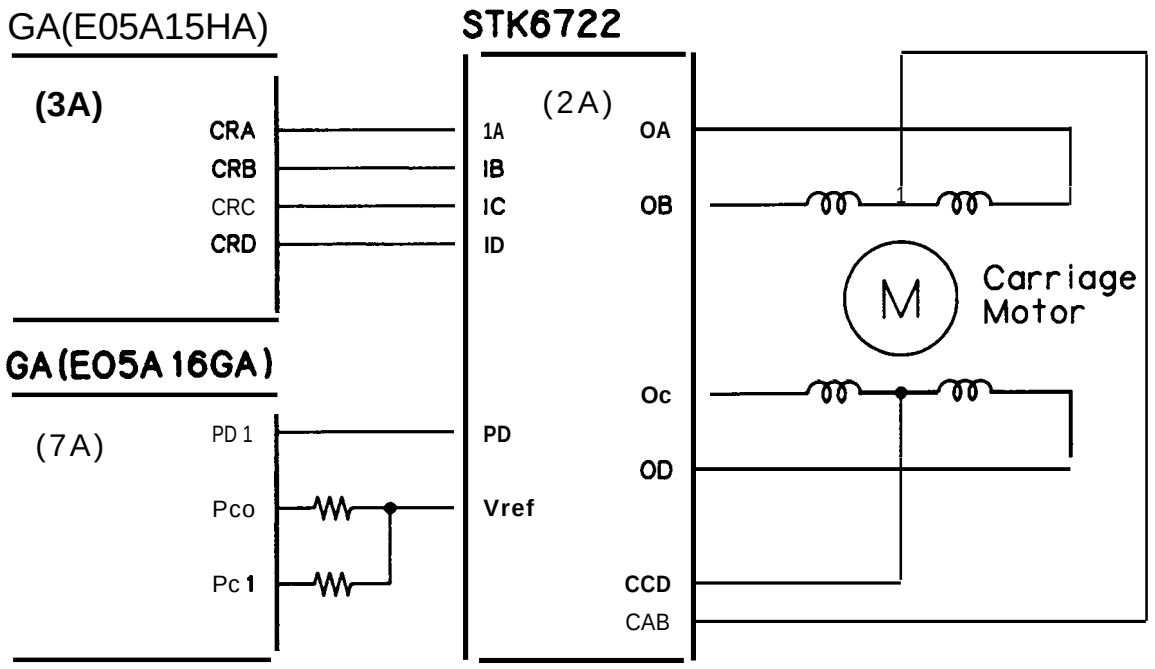
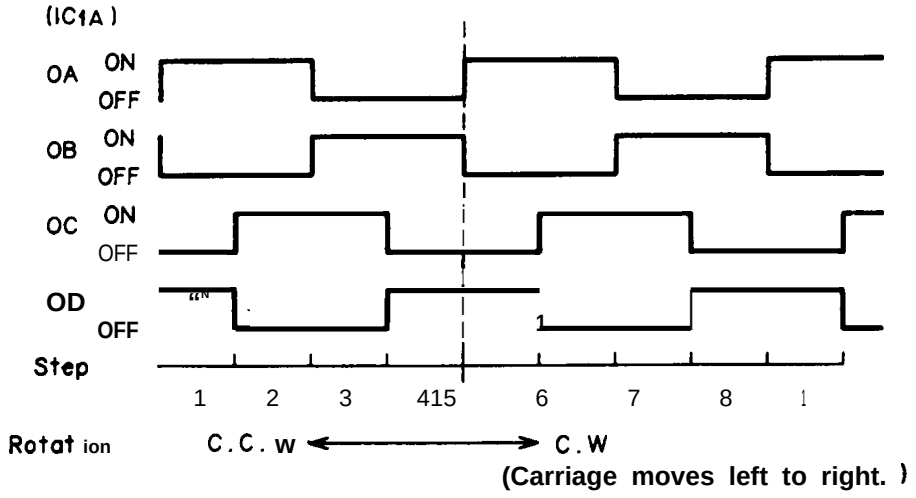


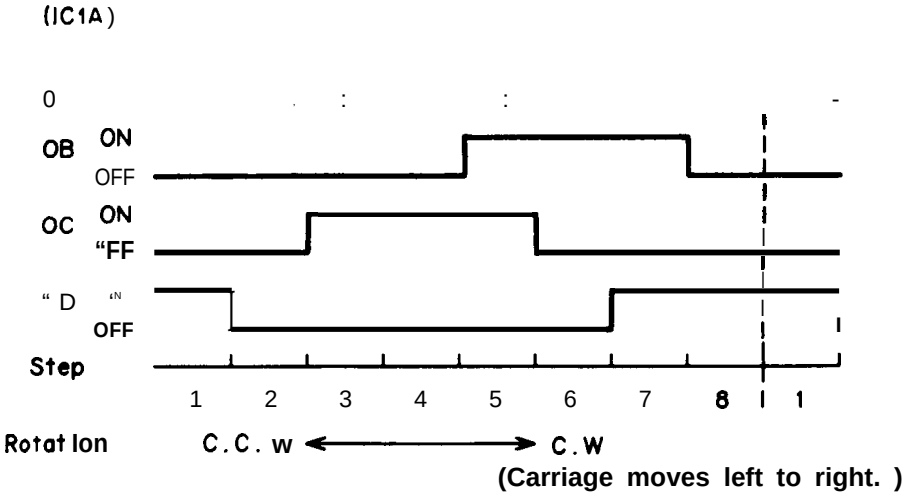
Figure 2-36. Carriage Motor Drive Circuit Block Diagram

Carriage Motor Excitation System

The carriage motor is controlled by the carriage motor constant current drive circuit. The phases of the carriage motor are controlled by CRA - CRD of the gate array (IC3A: E05A 15GA). Two drive systems, 2-2 phase and 1-2 phase excitation, are used. Because the carriage motor has one driving transistor per winding (unipolar drive), two drivers become active in the 2-2 phase excitation system and one and two drivers become active alternately in the 1-2 phase excitation system. Figure 2-37 shows the carriage motor drive sequences.



(a) 2-2 Phase Excitation



(b) 1-2 Phase Excitation

Figure 2-37. Carriage Motor Drive Sequence

• Drive Sequence

When driving the carriage, the phase excitation sequence differs depending the carriage speed and direction. The table below shows the phase excitation sequences.

Table 2-7. 2-2 phase Excitation

Drive Sequence	Left to Right				Right to Left			
Step No.	Phase A	Phase B	Phase C	Phase D	Phase A	Phase B	Phase C	Phase D
1	ON			ON	ON		ON	
2	ON		ON		ON'			ON
3		ON	ON			ON		ON
4		ON		ON		ON	ON	

Table 2-8. 1-2 phase Excitation

Drive Sequence	Left to Right				Right to Left			
Step No.	Phase A	Phase B	Phase C	Phase D	Phase A	Phase B	Phase C	Phase D
1	ON			ON	ON		ON	
2	ON				ON			
3	ON		ON		ON			"ON
4			ON					ON
5		ON	ON			ON		ON
6		ON				ON		
7		ON		ON		ON	ON	
8				ON			ON	

General Operation

Figure 2-38 shows the block diagram of IC2A (STK6722). The carriage motor has four coils A, B, C, and D, and each coil is driven by the corresponding phase driver A to D. These phase drivers are switched directory by the output pulses from ports CRA to CRD of the gate array (IC3A: E05A15HA). When the phase drivers are turned off, the surge voltage (e = – L X di/dt) generated from the coils of the carriage motor is applied to the surge voltage absorber via the flywheel diode attached to each phase driver, and is absorbed.

This circuit drives the carriage motor using a constant current chopper type drive system. Most of this circuit is included in the 4 phase stepper motor driver IC (IC2A: STK6722HA). Chopper control is performed using a separately-excited system (oscillation frequency: approximately 24 KHz). The carriage motor supply voltages V_{CAB} and V_{CCD} are applied intermittently so that the coil current is kept constant.

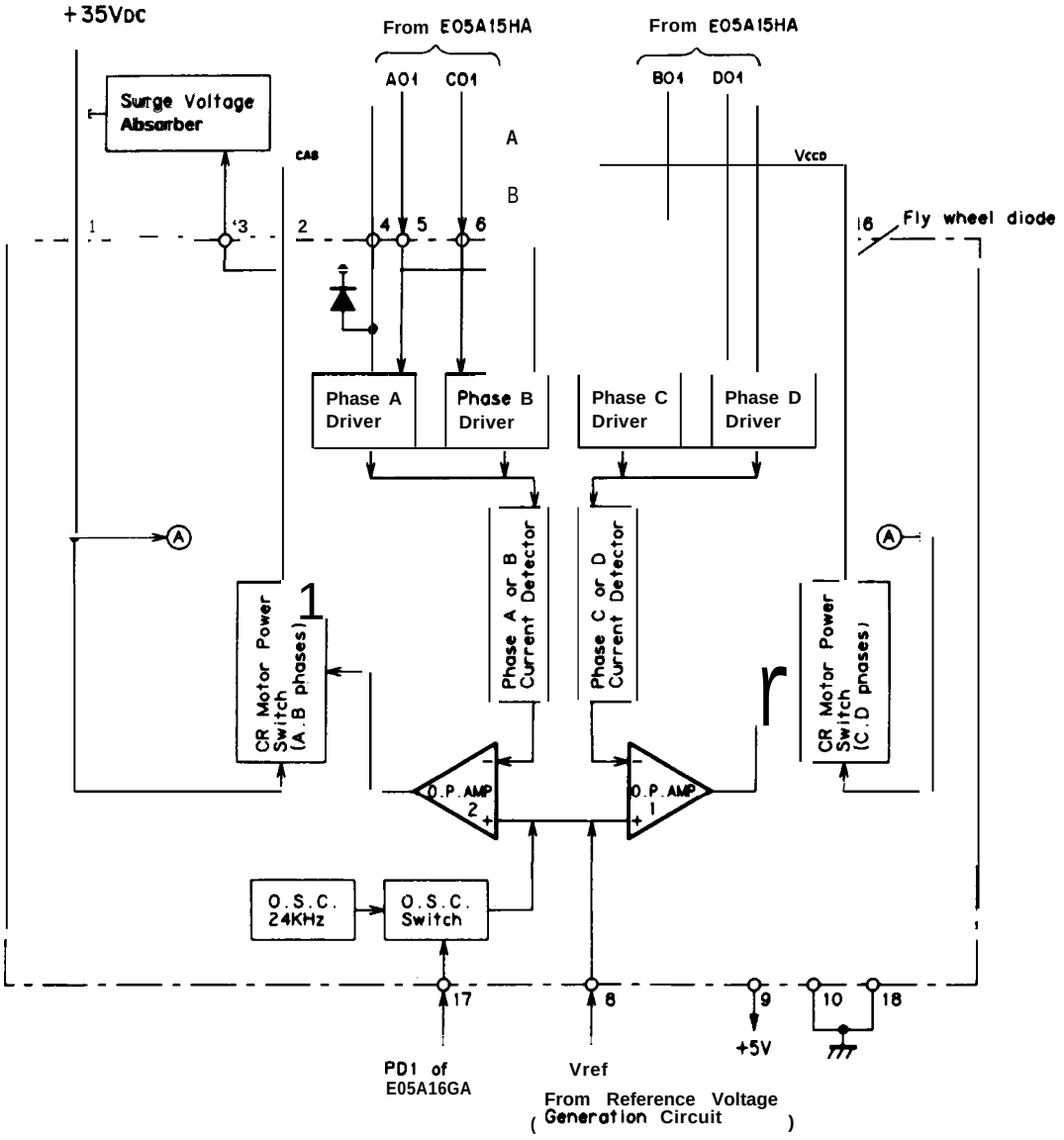


Figure 2-38. Carriage Motor Drive Circuit Block Diagram

Detailed Operation (Figure 2-39.)

- **When the + 5V supply voltage is applied to the STK6722HZ (IC2A), the triangular waveform circuit in the H-IC starts oscillation and outputs the reference signal (approx. 24KHz) for chopper control.**
- **Because the output of comparator IC2 (point Ⓐ) is high (input at the plus side > input at the minus side) when the printer power is turned on, TR7 turns on and base current flows to TR 1. When a high signal (AO 1: low) is input to the base of TR3, TR3 turns on, and coil current I_{CA} flows from V_{CC1} to TR 1 to phase A to D5 to TR3 to R 13. I_{CA} gradually increases due to the reactance of the motor coil. Voltage V_{R13} across limiter resistance R13 increases. When V_{R13} becomes the same as the V_{REF} at pin 8 (from the reference voltage generation circuit), the output of IC2 (point Ⓐ) goes low, TR7 turns off, and TR 1 turns off. Then I_{CA} starts decreasing. When V_{R13} becomes less than V_{REF}, the output of IC2 goes high again.**
- **The surge voltage (also called flyback voltage) generated when TR3 is cut off by the zener diode ZD 1 (approx. 47V) between the collector and base of transistor Q5, and is absorbed by transistor Q5 to protect TR3 from being damaged.**
- **When the carriage motor stops, the motor drive pulses are fixed at a set value to hold the carriage motor. At this time, H-IC is powered down to prevent it from overheating. When the power down operation is performed (when the carriage motor is held), PD 1 of the E05A 16GA (IC7A) goes low, and TR 11 turns on to drop the reference voltage at the plus side of IC2. As a result, the load on $V_{COM}AB$ is reduced and H-IC is effectively powered down, At this time, approximately 5V is supplied to $V_{COM}AB$ by PWM control.**

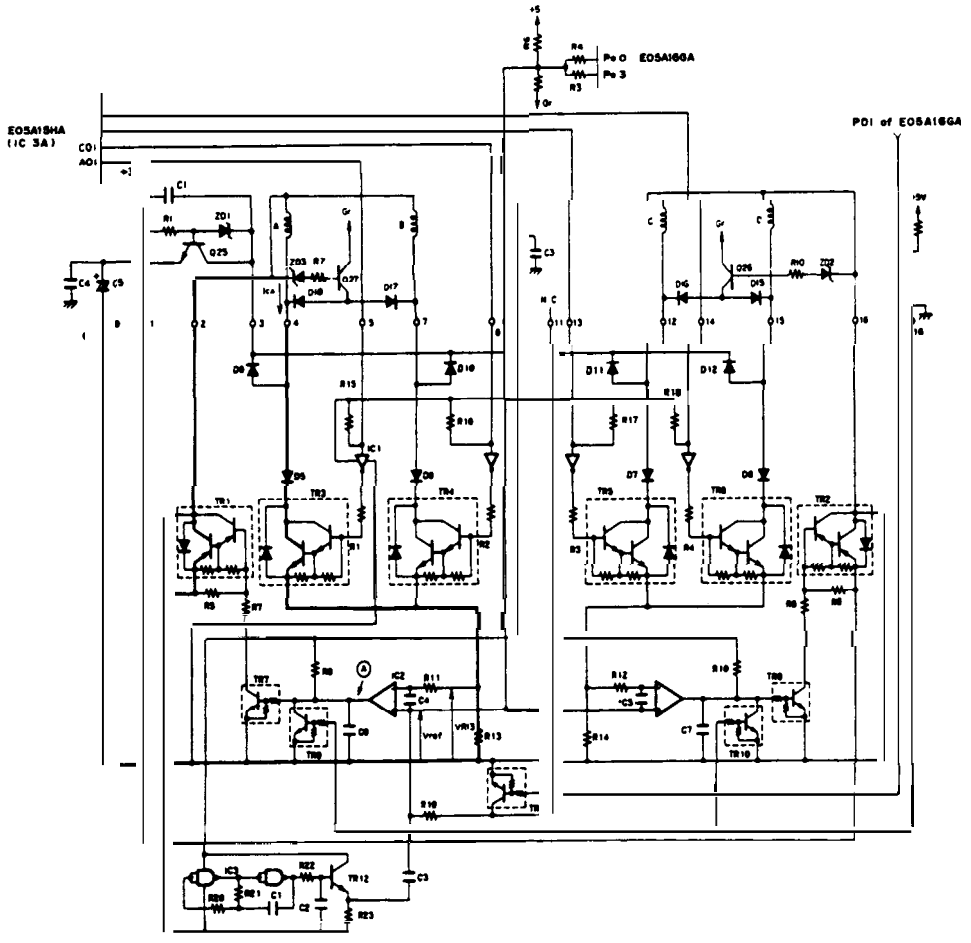


Figure 2-39. Carriage Motor Control Circuit

2.3.5.2 Carriage Motor Software Control

This section describes the carriage motor software control.

Software Control System

The carriage motor speed is controlled by the printer firmware. Various types of characters (NLQ: Near Letter Quality, Draft, and condensed) can be printed by controlling the print and paper feed mechanisms and the carriage motor speed. The printer has the six speed modes shown in Table 2-9.

Table 2-9. Carriage Speed Modes

Speed Mode	Cerriage Speed	Excitation System	Description
	pps	Phase	
1	3840	2-2	High speed skipping
2	2640	2-2	Draft ESC K. ESC Y
3	2134	2-2	ESC*5
4	1280	1-2	ESC*6, Draft half, emphasis, NLQ ESC L, ESC Z, ESC*4
5	1067	1-2	ESC*7
6	640	1-2	emphasis-condensed NLQ-Condensed Double height

Note: The carriage speeds and number of PPS (pulse per second) for the 1-2 phase excitation system are transformed into these for the 2-2 phase excitation system.

● **Speed Control**

Since a stepper motor is used as the carriage motor, holding at any position and reversing the printing direction are possible. The carriage motor control uses an open-loop system, and the carriage position is synchronized with the phase switching by the firmware. Acceleration, constant speed, and deceleration control is performed as described below.

Acceleration control:

The carriage motor is accelerated in accordance with the acceleration time table. The acceleration time varies depending on the speed mode. Table 2-10 shows the differences between the speed modes.

Table 2-10. Acceleration/Deceleration Control

Speed Mode	Carriage Speed	Phase Excitation	Acceleration/ Deceleration	Constant Speed
	pps		steps	ins/step
1	3840	2-2	36	0.286
2	2640	2-2	24	0.379
3	2134	2-2	24	0.469
4	1280	1-2	48	0.391
5	1067	1-2	48	0.469
6	640	1-2	48	0.781

Constant Speed Control:

The carriage motor constant speed depends on the constant speed set time, which varies with the carriage speed mode. Printing is possible when the carriage moves at a constant speed. Table 2-10 shows the set times for constant carriage speed.

Deceleration Control:

The carriage motor is decelerated in accordance with the deceleration time table. The deceleration time varies depending on the speed mode. The number of deceleration steps for each speed mode are the same as the acceleration steps at the corresponding speed mode. Refer to Table 2-10.

High Speed Skip:

High speed skip causes the carriage to skip over blank areas at the high speed of 3840 PPS. If a blank area continues for nine characters (normal characters) or more after a print command (CR or LF command) is received, the carriage is controlled to skip the area at the high speed of 3840 PPS. As the carriage comes to the end of the blank area, the carriage speed is lowered so that printing can be started at the speed corresponding to the specified printing mode. Figure 2-40 shows the high speed skip operation.

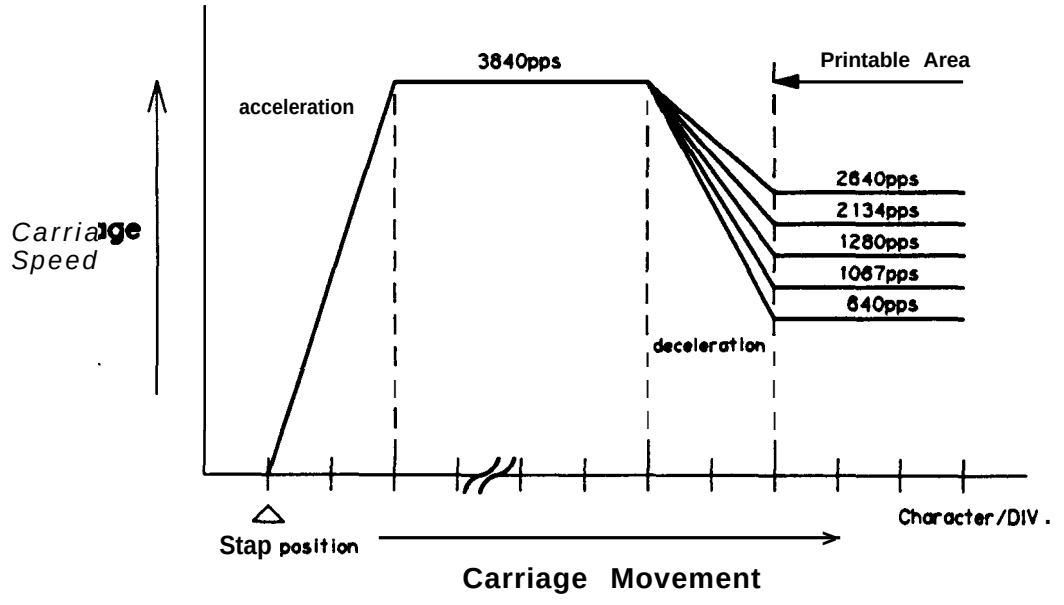


Figure 2-40. High Speed Skip Operation

Home Position Seek Operation

The function which moves the carriage to the home position after CPU inputs $\overline{\text{RESET}}$ signal is called home position seek. This is operated by driving the carriage motor. Figure 2-41 shows the operation flow and Figure 2-42 shows the phase state of home position seek.

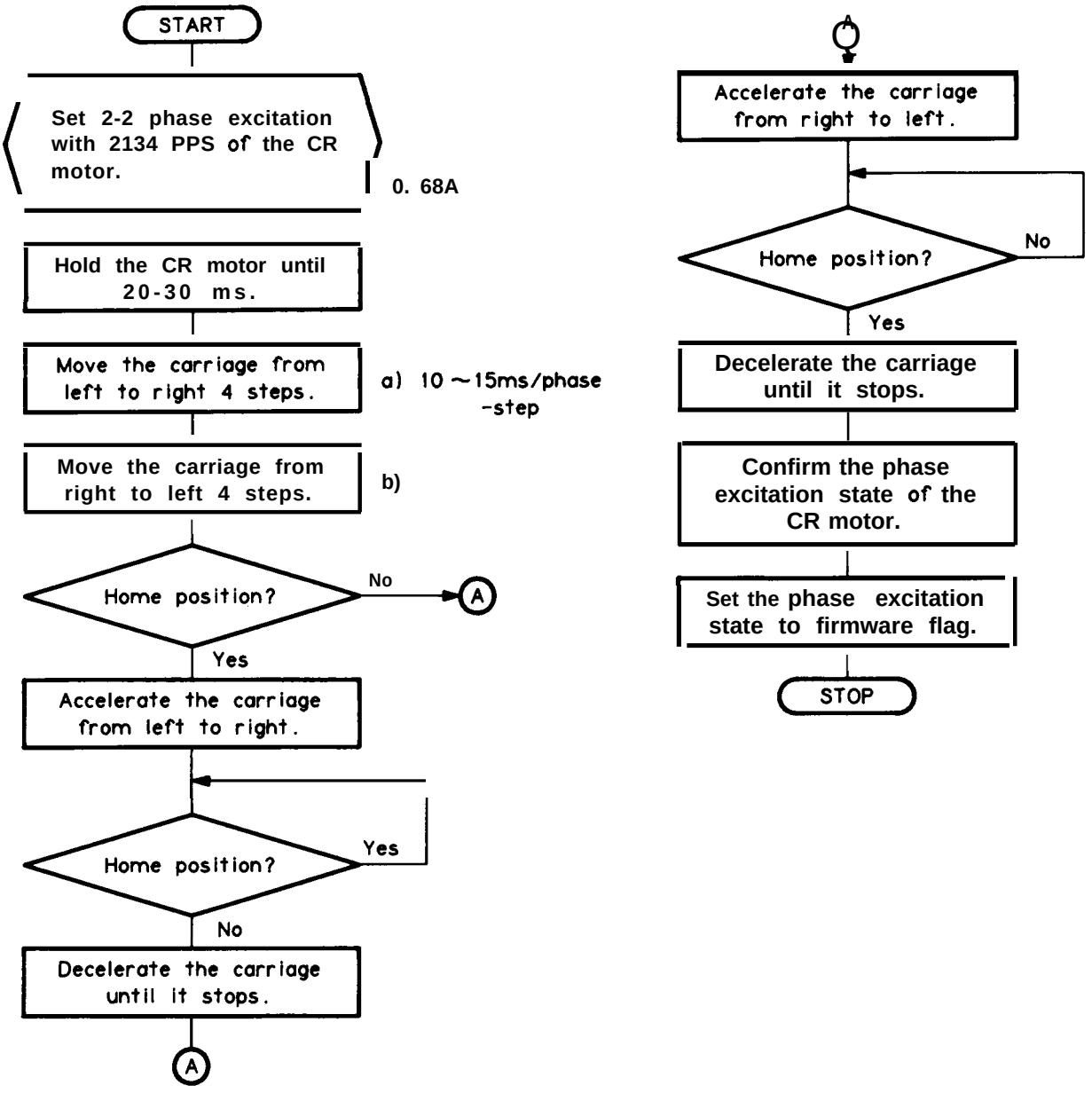


Figure 2-41. Home Position Seek Operaiton

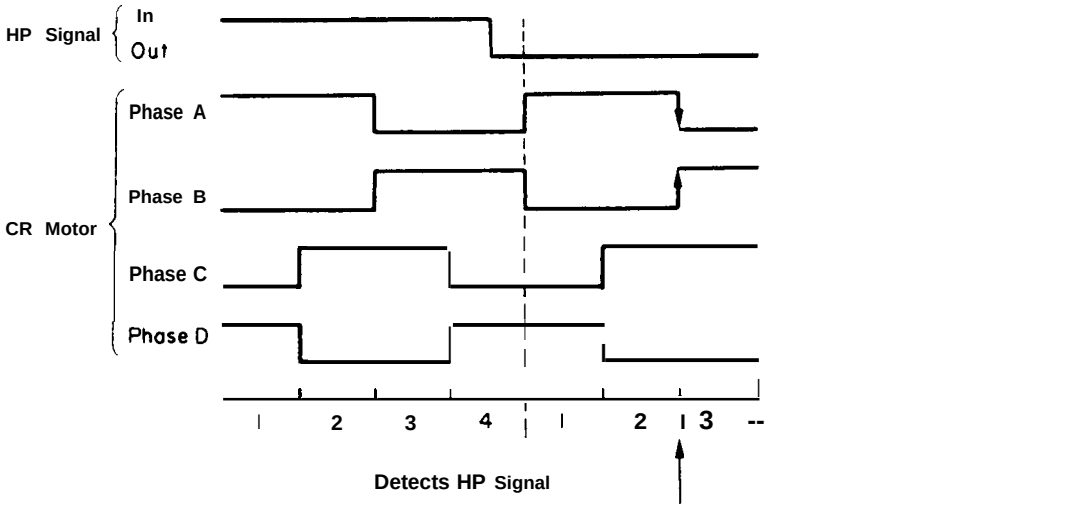


Figure 2-42. Home Position Seek Phase States

2.3.5.3 Paper Feed Control Circuit

The paper feed mechanism of this printer is driven by the paper feed motor. The paper feed motor is controlled by a gate array (IC3A: E05A1 5HA) and the CPU. Figure 2-43 shows the paper feed motor drive circuit block diagram.

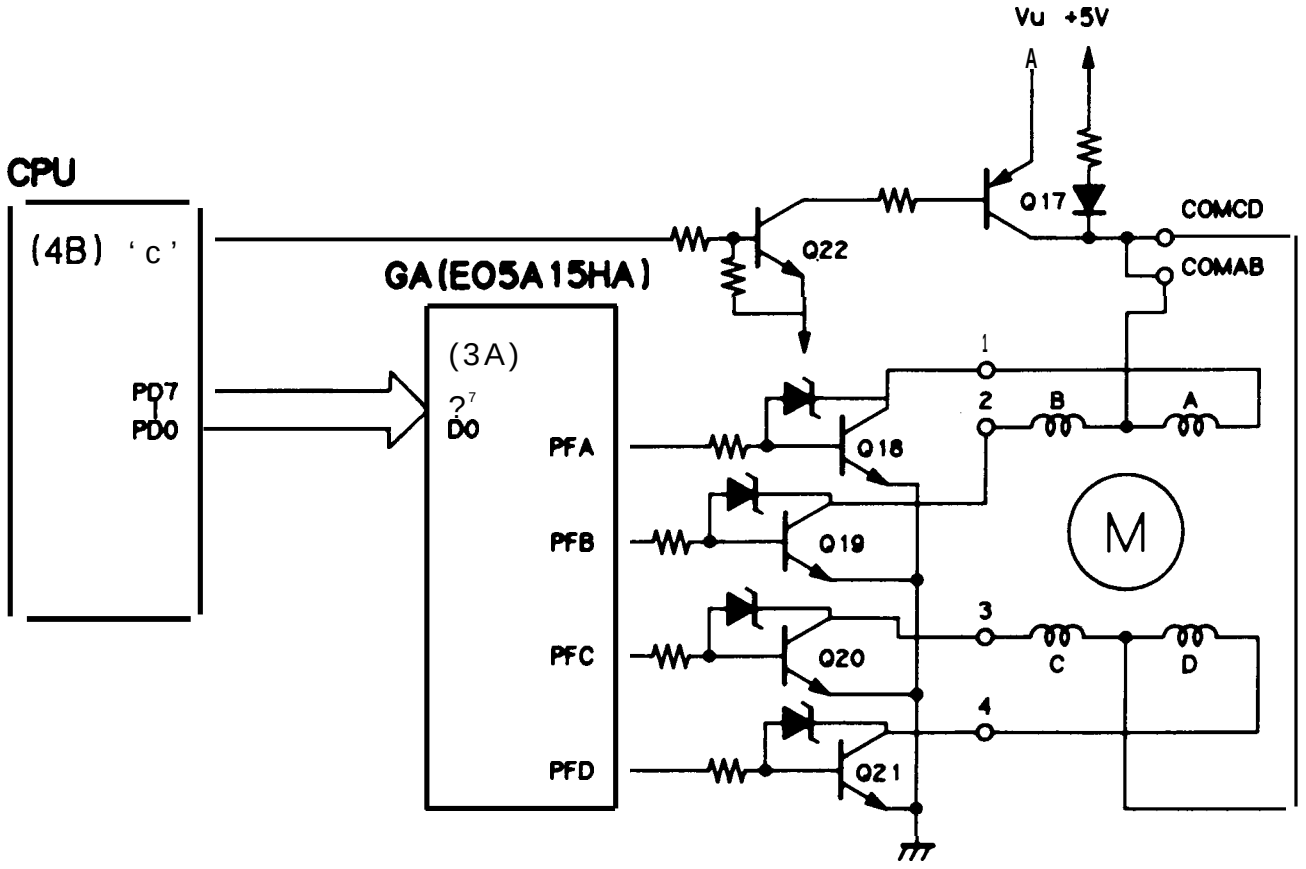


Figure 2-43. Paper Feed Motor Drive Circuit Block Diagram

As you can see in Figure 2-43, the paper feed motor drive voltage is controlled by PC7 from the CPU, and phase switching is performed by the gate array (I C3A). The paper feed motor rotates in both forward and reverse directions. Since the paper feed motor rotates in the reverse direction only for micro adjustment or sheet load/eject, the paper feed motor cannot be rotated in the reverse direction by any control codes.

● Paper Feed Motor Specifications

Type	4-phase 48-pole PM type stepper motor
Voltage	Driving: +36 VDC
	Holding: +5 VDC
Coil Resistance	78Ω±3Ω at 25" per phase
Current	Driving: 1.2 A (max.)
	Holding: 0.08 A(typical)
Excitation	2-2 phase
Paper Feed Pitch	0.118 mm/pulse (4.23 mm: 1/6": 36 pulse)

- **Gate Array (IC3A: E05A15HA)**

This gate array (IC3A) directly controls phase switching for the paper feed motor to switch the rotational direction, under control of the CPU. Data for phase switching is sent from the CPU, expanded in the paper feed motor phase switching circuit, and output as the phase switching signal to switch the rotational direction of the paper feed motor.

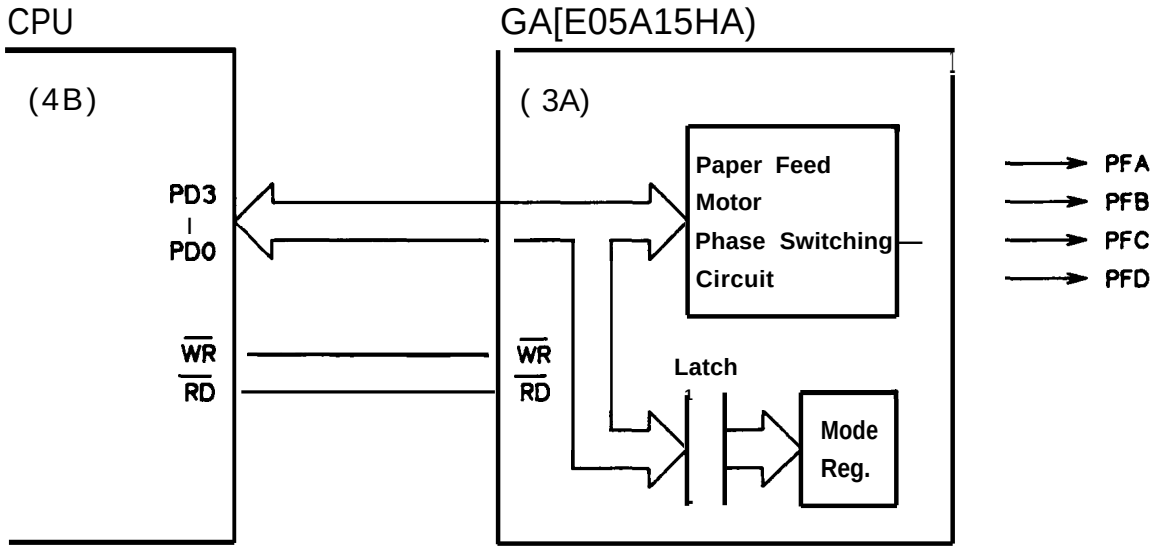


Figure 2-44. GA (E05A15HA) Function for Paper Feed Motor

Paper Feed Motor Excitation System

The paper feed motor is controlled by the open-loop constant voltage drive circuit. The phases of the paper feed motor are controlled by PFA-PFD of the gate array (IC3A: E05A15HA).

2-2 Phase excitation system is used.

The paper feed motor has one driving transistor per winding (unipolar drive), two driver's become active in the 2-2 phase excitation system.

Figure 2-45 shows the 2-2 phase excitation system.

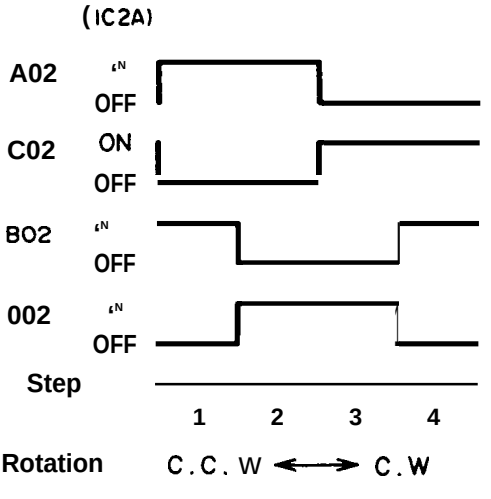


Figure 2-45. Phase Excitation System

● **Drive Sequence**

When driving the paper feed motor, the phase excitation sequence differs depending the paper feed direction. The table below shows the phase excitation sequence.

Table 2-11. 2-2 phase Excitation

Drive sequence	Foward Feed				Reverse Feed			
Step No.	Phase A	Phase B	Phase C	Phase D	Phase A	Phase B	Phase C	Phase D
1	ON		ON		ON			ON
2	ON			ON	ON		ON	
3		ON		ON		ON	ON	
4		ON	ON			ON		ON

NOTE: If the paper feed motor is driven counterclockwise, paper is fed in reverse.

2.3.5.3 Paper Feed Motor Software Control

This section describes the paper feed motor software control.

Software Control System

The speed and rotational direction of the paper feed motor are controlled by the printer firmware. Line spacing is also controlled by the firmware. The minimum line spacing value that the user can set is 1/2 16 inch. The printer supports the following three speed modes for paper feeding.

Table 2-12. Paper Feed Motor Speed

Speed Mode	Feed Speed	Excitation System	Description
1	660 pps	2-2 Phase	Continuous paper feed
2	720 pps	2-2 Phase	Cut sheet intermittent feed
3	780 pps	2-2 Phase	Cut sheet continuous feed

The paper feed direction is operated by following operation shown in Table 2-13.

Table 2-13. Paper Feed Direction and Operation

Feed Direction	Description
Forward	. Control Panel Operation (FF or LF switch) ● Print Operation ● Paper Load Operation ● Micro Adjustment Operation
Reverse	● Paper Back-out Operation ● Paper Load Operation ● Micro Adjustment Operation

● **Speed Control**

Since a stepper motor is used for the paper feed motor, holding at any position is possible. Acceleration, constant speed, and deceleration of the paper feed motor are performed by the firmware, just like the carriage motor. The speed control methods are described below.

Acceleration Control:

The paper feed motor is accelerated in accordance with the acceleration time table. The acceleration time varies depending on the speed mode. Table 2-14 shows the differences between the speed modes.

Table 2-14. Acceleration/Deceleration Mode

Speed Mode	Feed Speed	Excitation System	Acceleration/ Deceleration	Constant Speed
1	660 pps	2-2 Phase	7/6 Steps	1.52 mS
2	720 pps	2-2 Phase	7/6 Steps	1.39 mS
3	780 pps	2-2 Phase	7/6 Steps	1.28 mS

Constant speed control:

The paper feed motor constant speed depends on the constant speed set time, which varies depending on the speed mode. Table 2-14 shows the set times for constant paper feed motor speed.

Deceleration control:

The paper feed motor is decelerated in accordance with the deceleration time table. The deceleration time varies depending on the speed mode. The number of deceleration steps for each speed mode are the same as the acceleration steps at the corresponding speed mode. When the paper feed motor decelerates and stops, the drive voltage (+36 V) is turned on and off (chopping) so that the motor stops stably. When the paper feed motor stops, the motor drive control is performed during the drive voltage chopping operation so that any backlash in the gears of the paper feed mechanism can be taken up.

Paper feed control in the NLQ mode

When the NLQ (Near Letter Quality) printing operation shifts from the first pass to the second pass, the phase excitation system for the paper feed motor changes from the 2-2 phase excitation system. The paper feed motor is driven once using the 2-2 phase excitation system, then once using the 1-2 phase excitation system. Therefore, when the NLQ printing operation is on the second pass, the paper feed motor is held by the 1-2 phase excitation system.

Paper Loading/Ejecting Operation Flow

Figure 2-46 shows the general operation chart of the paper loading/ejecting sequence.

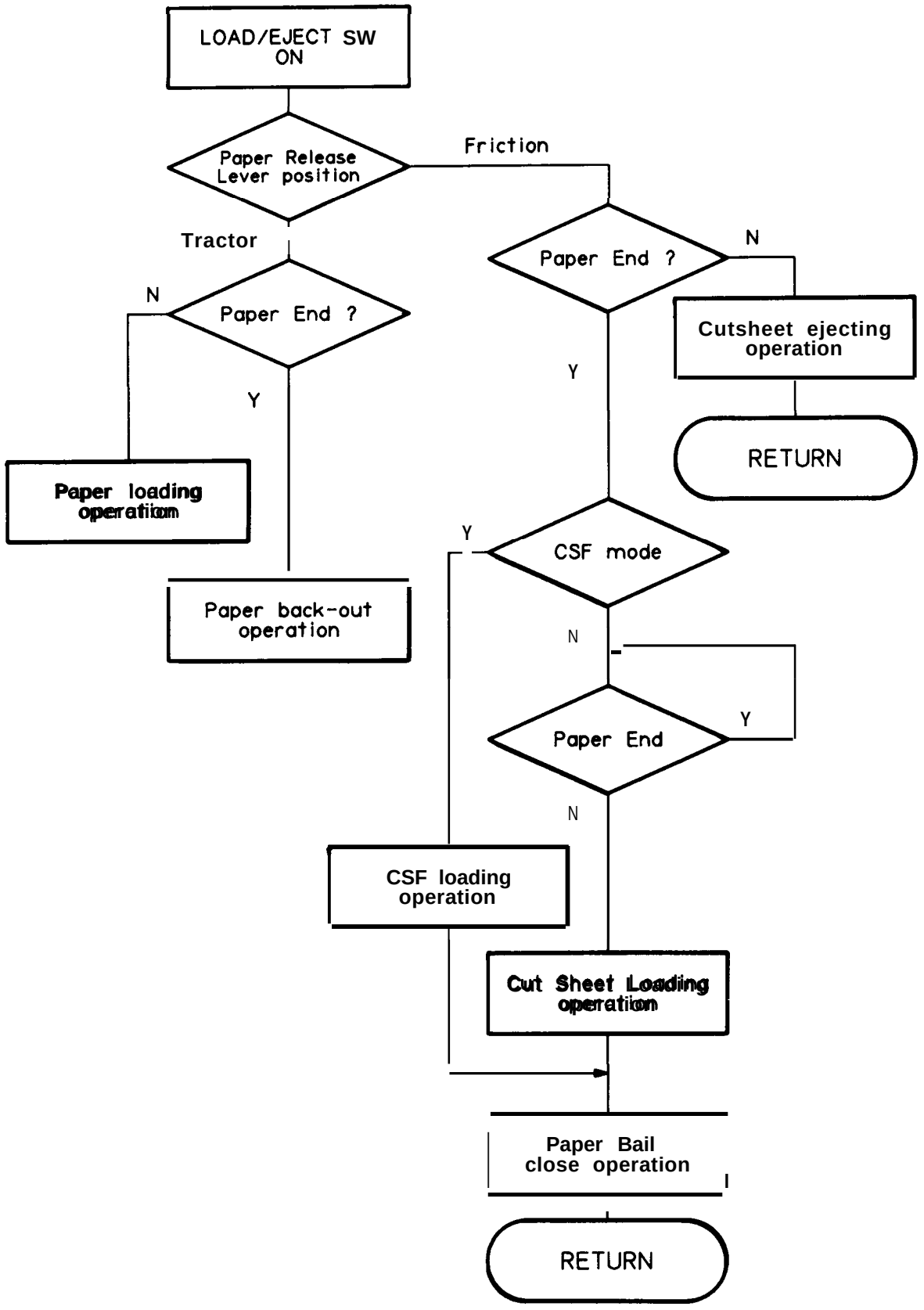


Figure 2-46. Paper Loading/Ejecting Operation

2.3.5.4 Plunger Drive Circuit

The gate arrays E05A 15GA(7A) and E05A 16HA (3A) control this circuit to drive the plunger to open and close the paper holding lever for paper auto loading/ejection. Figure 2-47 shows the drive mechanism, Figure 2-48 shows the shows the plunger drive circuit and Figure 2-49 and Table 2-15 shows the on/off timing of the transistors during the plunger drive and paper holding.

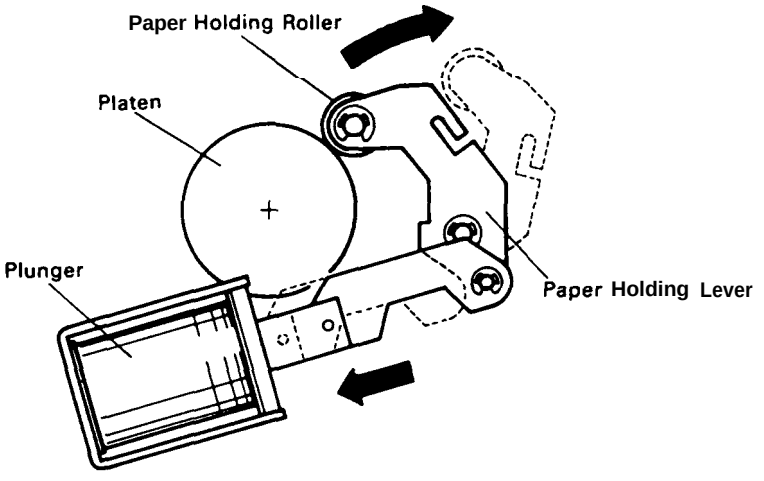


Figure 2-47. Plunger Mechanism

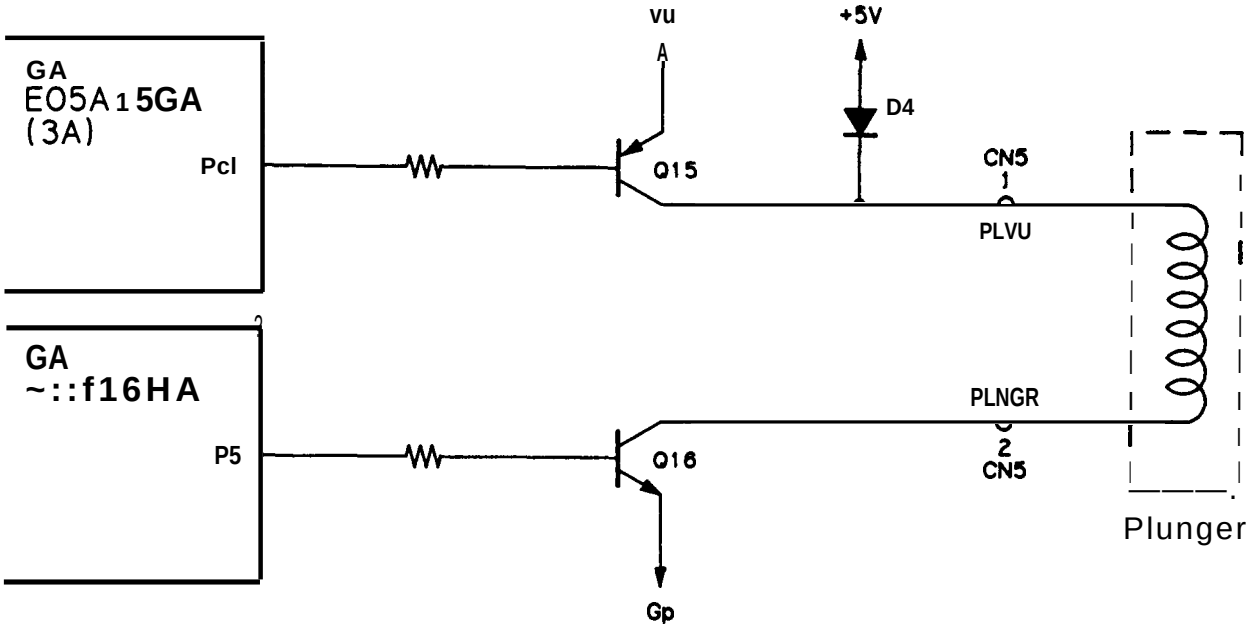


Figure 2-48. Plunger Drive Circuit

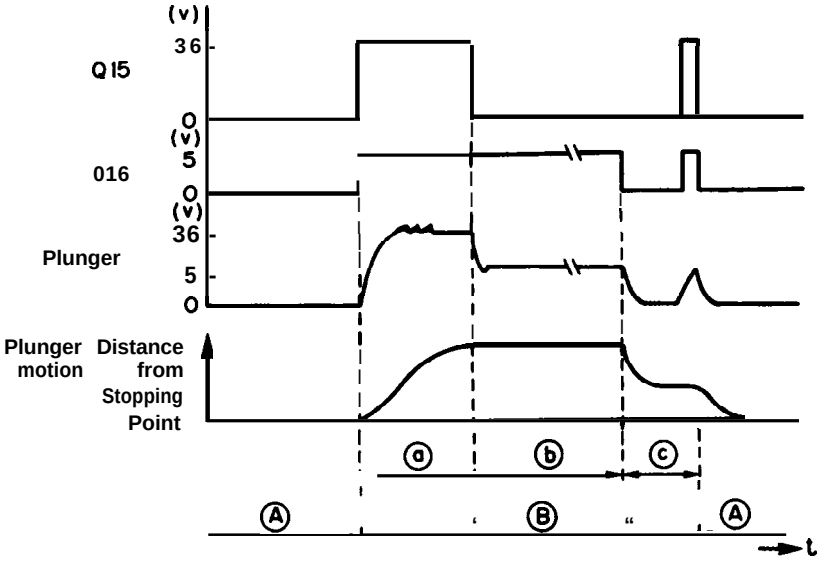


Figure 249. Relationship Between Transistors and Plunger Voltage

Table 2-15. Relationship Between GA Ports and Plunger Voltage

Supplied Power [V] (plunger)	Q16	Q15	E05A15GA Pcl	E05A16HA P5
o	OFF	OFF	HIGH	LOW
5	ON	OFF	HIGH	HIGH
	ON	ON	LOW	HIGH

Plunger Specifications

Voltage **Driving** : +36 V
Holding : +5 v
No operation: O V
Coil Resistance 22 Ω ± 5% at 20°C
Current **Driving** : 1.6A (typical)
Holding : 0.23A (typical)

2.3.5.5 Printhead Control Circuit

Printing is controlled by the CPU (μPE78 10HG), gate array (E05A 15HA), nine drive transistors, and printhead. Print data output from the CPU is stored in the buffer of the E05A15HA gate array. The printhead drive pulse output from PC6 of the CPU enables the buffer is the gate array, and the 9 bits of print data stored in the buffer are output to turn on or off the printhead drive transistors so that the drive voltages are applied to the printhead coils. Figure 2-50 shows a block diagram of the printhead control circuit.

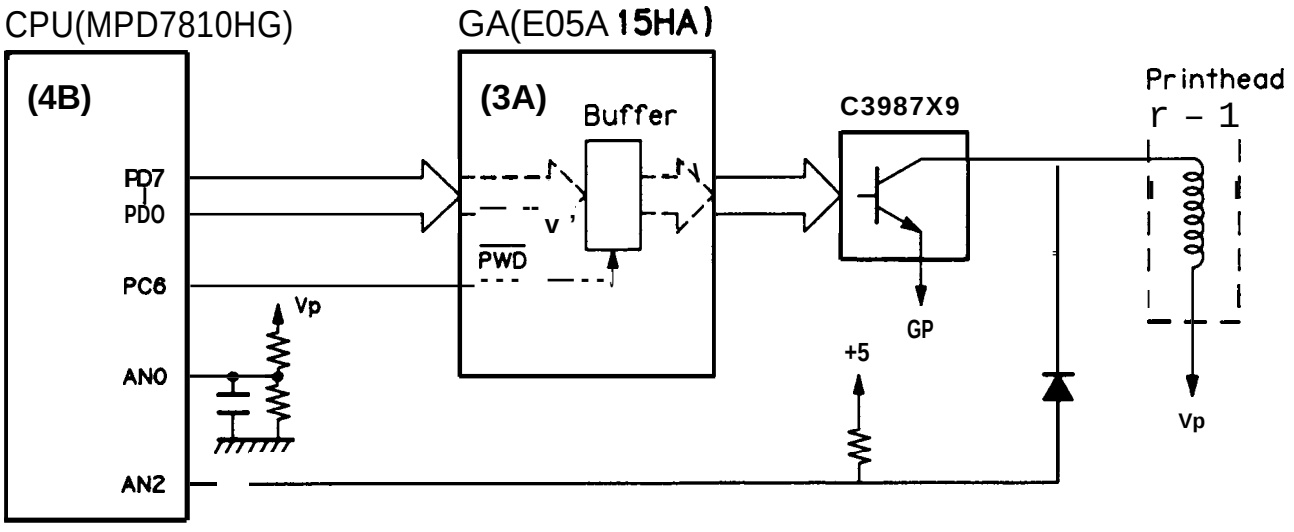


Figure 2-50. Printhead Control Circuit Block Diagram

Printhead Drive Pulse Width Control

The width of the printhead drive pulse is controlled by the CPU (μPD78 10HG). The CPU monitors printhead drive voltage VP (+24 V) at ANO, kand controls the width of the printhead drive pulse (output from PC6 of the CPU) by making it longer or shorter according to changes in the drive voltage, so as to keep the drive voltage constant in order to stabilize print quality. (See Figure 2-50.) Figure 2-51 shows the relationship between printhead drive voltage and print drive pulse width.

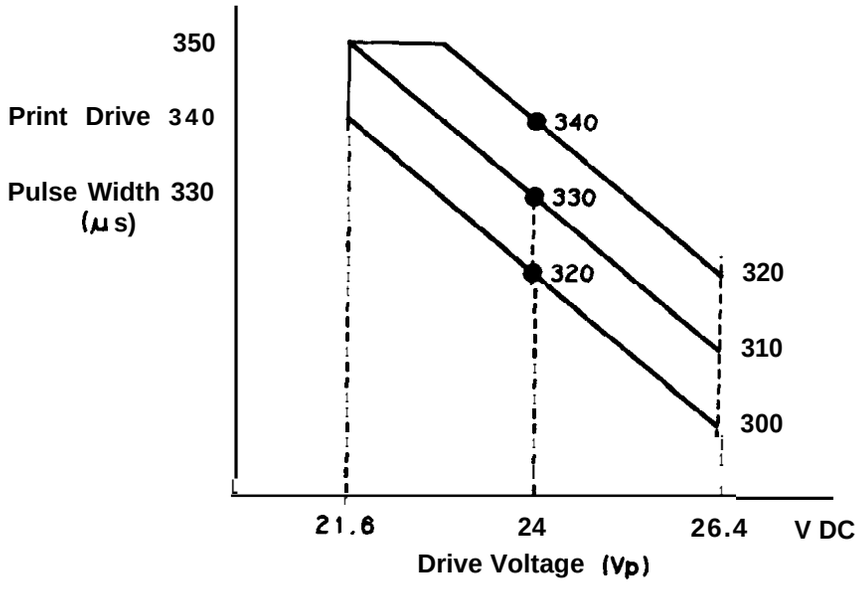


Figure 2-51. Print Drive Pulse Width

Half-dot Protection Circuit

The half-dot protection circuit is located in the gate array (E05A15HA). It ignores any drive pulses received after the dot wires of the printhead (see Figure 2-3) have been driven for the maximum allowable drive time, to prevent the printhead from being damaged.

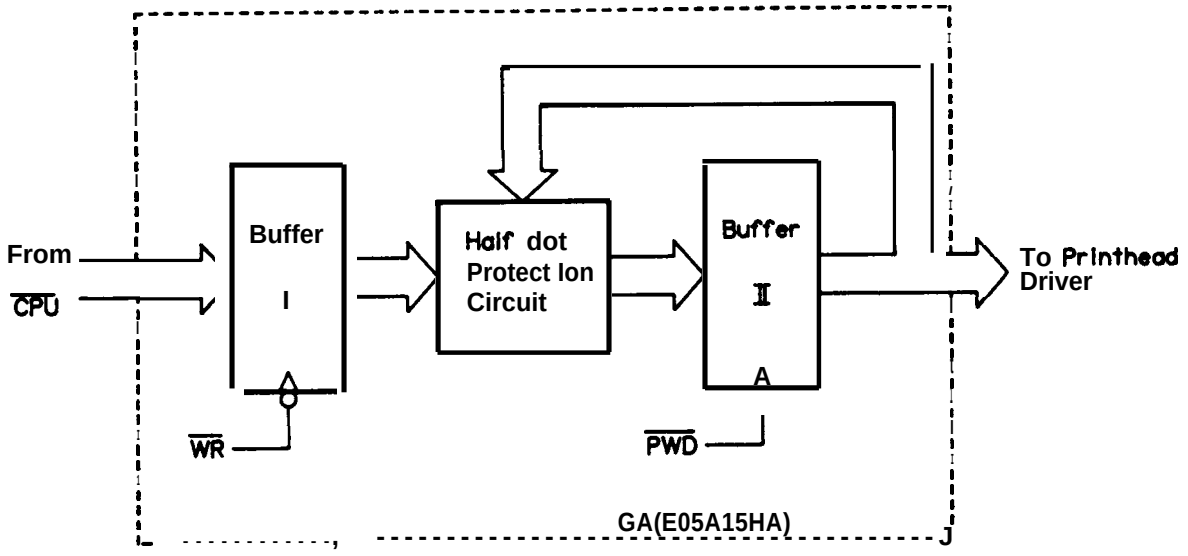


Figure 2-52. Half-dot Protection Circuit Block Diagram

Drive Transistor Short-circuit Check

During printing, the CPU continuously checks the printhead drive transistors (Q! to Q9) for short circuits. The short-circuit check is performed between drive cycles. If any of the drive transistors are shorted, a LOW signal is input to AN2 of the CPU. Upon receiving this signal, the CPU stops printing, shuts off the +24 V drive voltage, and rings the buzzer. (See Figure 2-50.)

Bi-directional Printing Alignment

For bi-directional printing, printing position alignment is performed. The print timing pulse is delayed when the printhead moves from right to left, to align the vertical printing positions printed when the printhead moves from left tot right with those printed right to left. If a misalignment occurs, it can be adjusted using the control panel (Seee Section 4.3.3.).

CHAPTER 3
OPTIONAL EQUIPMENTS

Intentionally omitted at this time

CHAPTER 4
DISASSEMBLY, ASSEMBLY, AND ADJUSTMENT

LIST OF FIGURES

LIST OF TABLES

4.1 GENERAL REPAIR INFORMATION

This chapter describes the disassembly procedures to be used for replacing any of the main components of the FX-850/1 050.
Required and helpful tools, measuring instruments, and lubricants listed in Tables 4-1 through 4-3.

Table 4-1. Maintenance Tools

Description	Necessary	Convenient	Part No.
Philips screw driver #2	o		B743800200
Box driver (7 mm across)	o		B74 1700200
Thickness gauge (0.50 mm)	o		B776700301
Round nose pliers	o		B740400100
Diagonal cutting nipper	o		B740500 100
Tweezers	o		B64 1000100
E-ring holder #2.5	o		B740900400
E-ring holder #3	o		B740800500
E-ring holder #4	o		B740800600
E-ring holder #5	o		B740800700
Alcohol	o		
Electric soldering iron		o	B740200 100
Brush No. 1		0	B74 1400200
Brush No. 2		0	B74 1400100
Cleaning brush		o	B74 1600100

0: Commercially available product
E: EPSON exclusive tool

Table 4-2. Measuring Instruments

Description	Specification	Necessary	Convenient
Multi meter	———	o	
Oscilloscope	20 MHz or more	o	
Logic analizer			o

Table 4-3. Lubricants and Adhesive

Description	Capacity	Availability	Part No.
o-2	40 cc	E	B7 10200001
G-27	40 gr	E	B702700001
Neji lock #2(G)	1000 gr	E	B730200200
Adhesive tape		o	

O: Commercially available product
E: EPSON exclusive product

Figure 4-1 shows some of the parts found on the FX-850/1050.

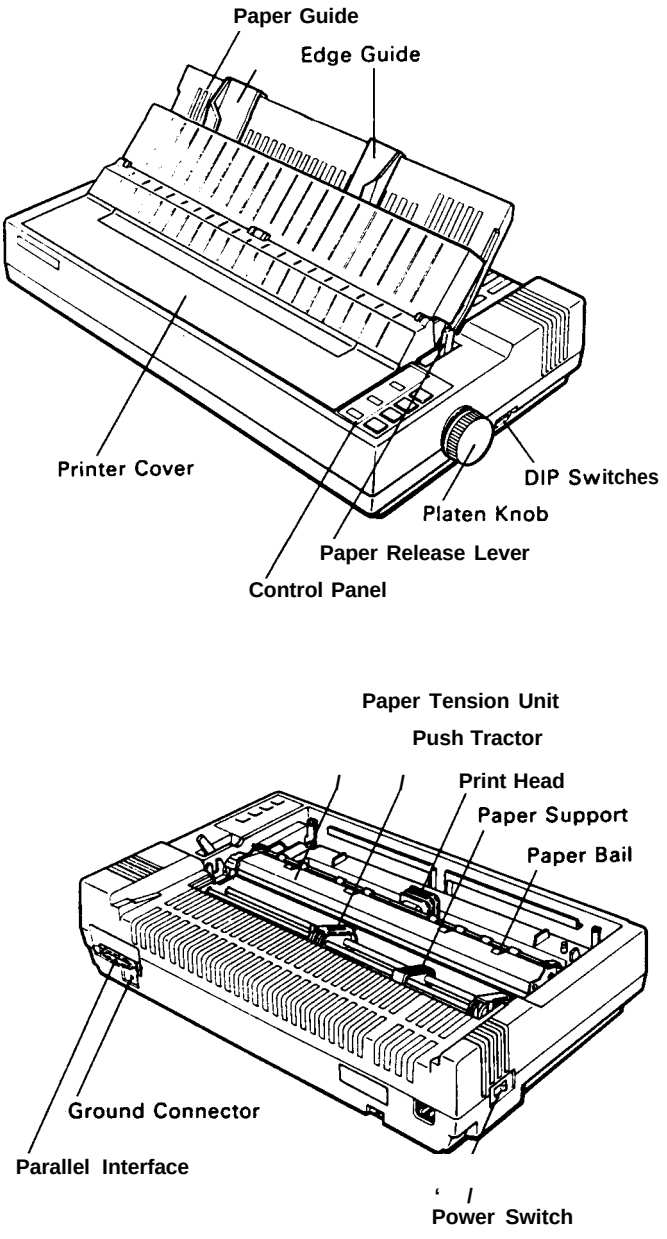


Figure 4-1. Parts of the FX-850/1050

WARNING

There are several precautions you should take after performing troubleshooting and when packing the printer for transport:

1. Remove the ribbon cartridge and platen knob.

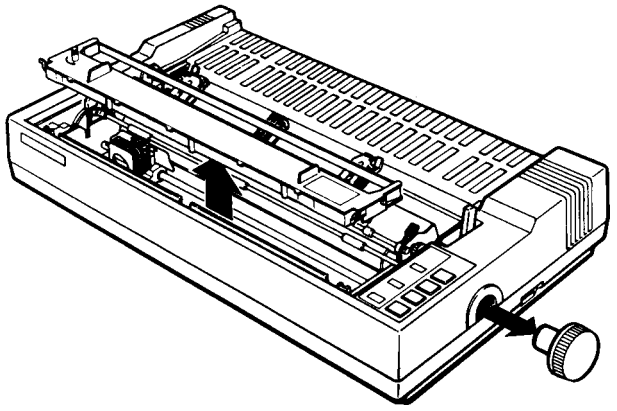


Figure 4-2. Ribbon Cartridge and Platen Knob Removal

2. Slide the printhead to the middle of the printer. Then, using a cross-head screwdriver, reattach the two transport locking brackets.

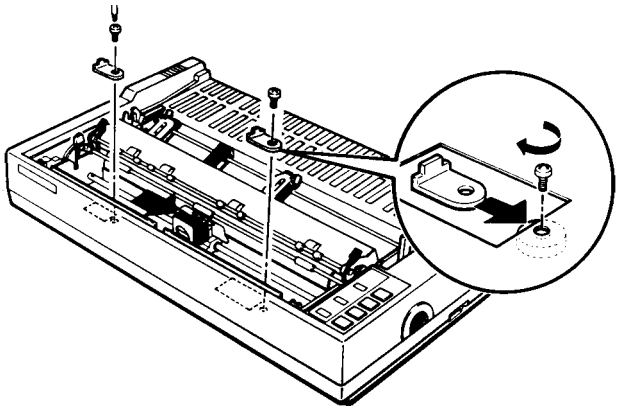


Figure 4-3. Transport Locking Brackets Installation

Attach the left and right locking tabs.

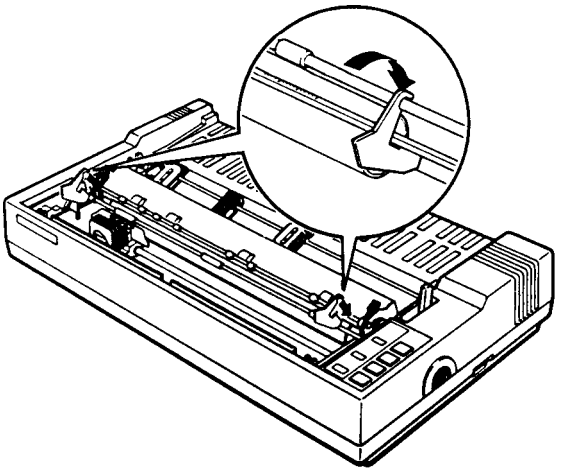


Figure 4-4. Locking Tabs Installation

Slide the print head all the way to the left, and insert the print head protector as shown below.

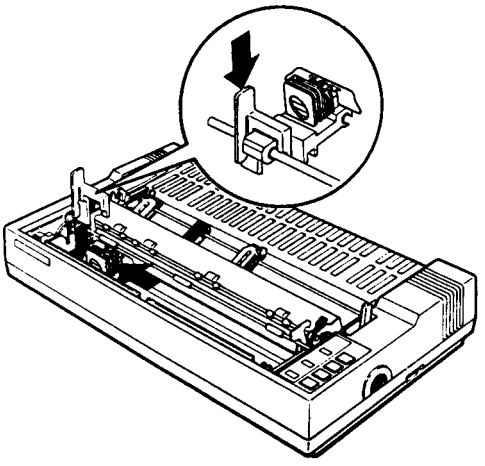


Figure 4-5. Printhead Protector Installation

4.2 DISASSEMBLY AND ASSEMBLY

Components of the FX-850\l 050 may be assembled simply by performing the disassembly operation in reverse sequence. Assembly procedures, therefore, have been omitted.

The sequence of this disassembly in this section is grouped into three parts: (1) removal of the upper case, (2) removal of the circuit boards, and (3) disassembly of the printer mechanism. This sequence is shown in Figure 4-6.

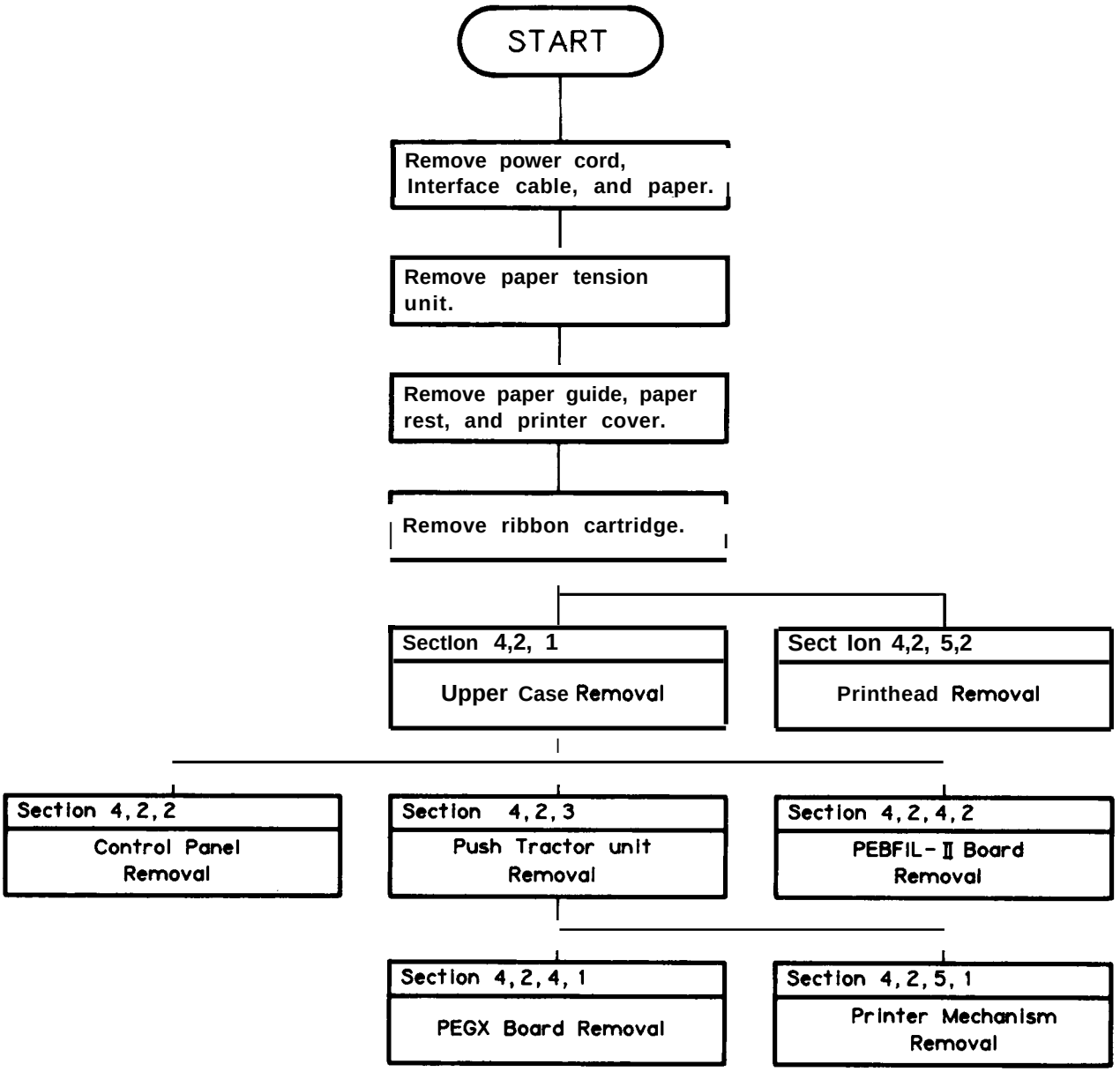


Figure 4-6. Printer Disassembly Procedures

Screws, washers, nuts, etc. are abbreviated using the conventions below.

Table 4-4. Abbreviations List of Small Parts

Abbreviation	Part Name
CBB (CTBB)	Cross-Bind-head B-tight
CBS (CTBS)	Cross-Bind-head S-tight
CBS (0) (CTB (0))	Cross-Bind-head S-tight with Outside-toothed washer
CBNS (CTBS (N))	Cross-Bind-Notch-head S-tight
CPS (0) (CTPS (0))	Cross-Pan-head S-tight with Outside-toothed washer
CPS (P) (CTPS (P))	Cross-Pan-head S-tight with Plain washer
CTB (0)	Cross Truss-head B-tight with Outside-toothed washer
HNO	Hexagon Nut with Outside toothed lock washer
RE	Retaining E-ring
PW	Plain Washer
LS	Leaf Spring

Table 4-5 illustrates the relationship between a screw's physical characteristics and its abbreviated part name.

Table 4-5. Form and Abbreviated Part Name of Screws

Head		Body	washer (assembled)
.Cross—recessed head	1. Bind	1. Normal	1. Plain washer
!. SLotted head	(with Notch)	2. Tap tight Stight	2. Outside toothed lock washer
	2. Pan	Btight	
	3. Cup	3. Tapping	3. Spring washer
	4. Truss		

4.2.1 Upper Case Removal

To check the interior of this printer, first remove the upper case using the steps listed in the paragraphs below.

DANGER

Prior to beginning the following procedures, be sure to disconnect the power cord and interface cable, and remove the paper installed in the printer.

Step 1: Remove the platen knob.
Step 2: Remove CBB (4 X 12) screw securing the upper and lower cases.

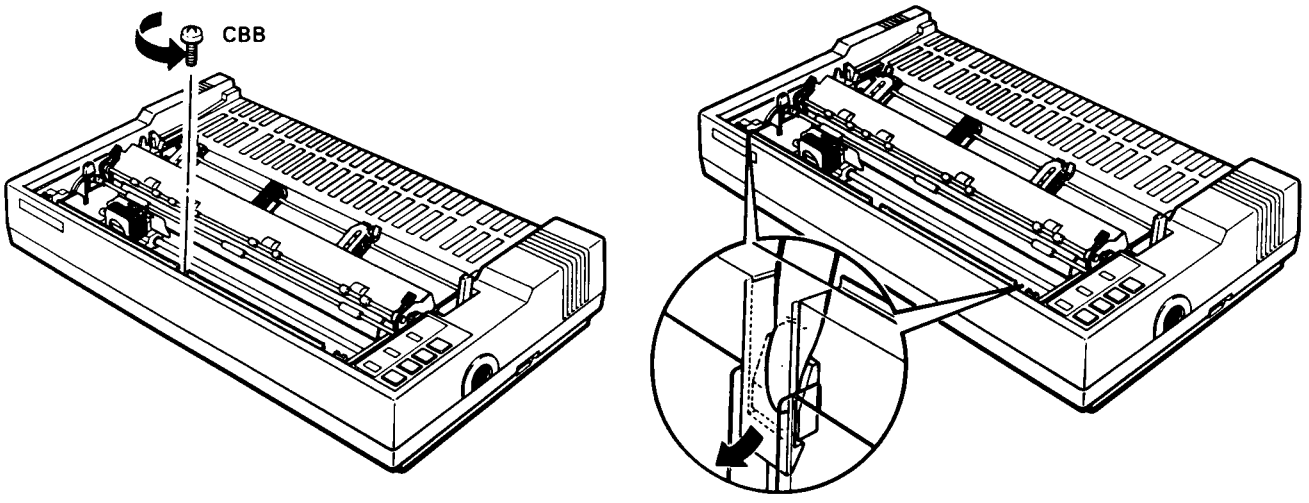


Figure 4-7. Upper Case Removal

Step 3: Detach the upper case by pressing in on the two retaining clips. These clips are located on both side of the printer case.
Step 4: Disconnect connector CN 11 which connects the PEGX board.
Step 5: Remove the upper case.

ASSEMBLY POINT

Before setting the upper case back onto the lower case, adjust the paper release lever toward the back.

4.2.2 Control Panel Removal

Step 1: Remove the upper case (Refer to Section 4.2.1.)
Step 2: Remove the control panel from the upper case depressing two hooks.

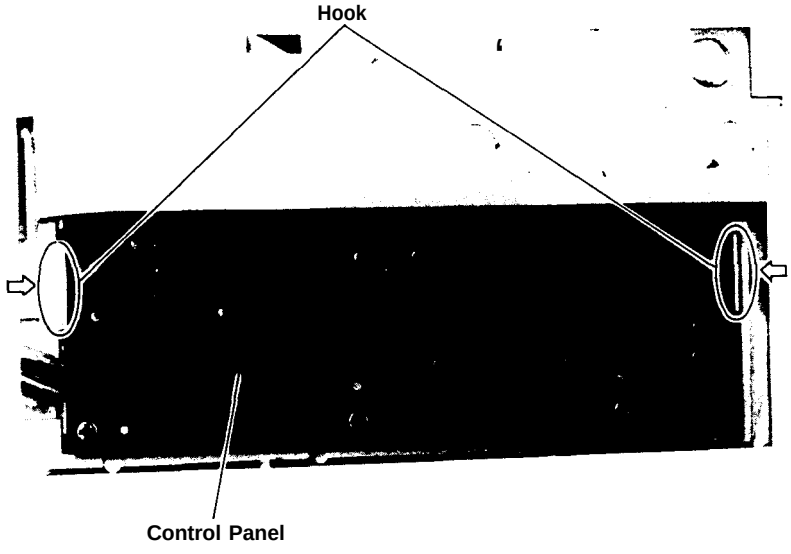


Figure 4-8. Control Panel Removal

4.2.3 Push Tractor Unit Removal

Remove the push tractor unit before removing the circuit boards and the printer mechanism from the lower case.

Step 1: Remove the upper case (Refer to Section 4.2.1 .).
Step 2: Remove the two CPS(O) (3X 6) screws securing the push tractor to the printer mechanism.
Step 3: Remove the push tractor unit by pushing it to the back.

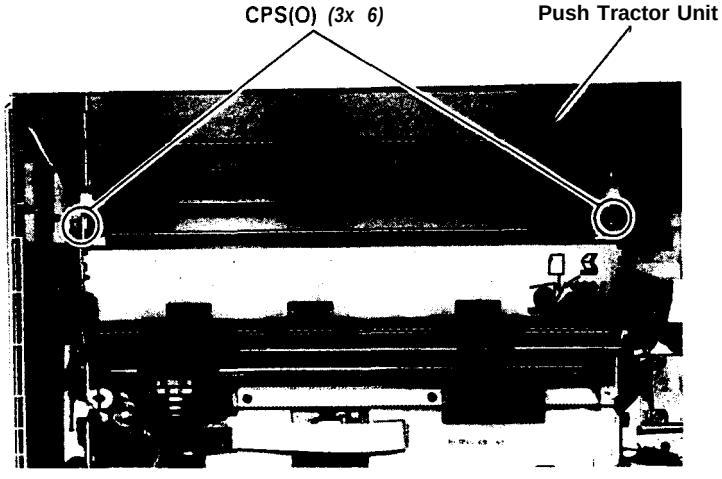


Figure 4-9. Push Tractor Unit Removal

4.2.4 Circuit Board Removal

This printer includes two circuit boards: the PEGX controller circuit board and PEBFIL-II filter circuit board.

CAUTION

Electricity leaks when you put the PEGX board on the electric-conductor materials. The lithium battery on the PEGX board always supply DC voltage to the static-RAM.

4.2.4.1 PEGX Board Removal

Step 1: Remove the upper case (Refer to Section 4.2. 1.).

Step 2: Remove the push tractor unit (Refer to Section 4.2.3.).

Step 3: Disconnect connector CN3 which connects the power transformer.

Step 4: Disconnect connectors CN4, CN5, CN6, CN7, CN8, CN9, and CN 10, which connect the printer mechanism.

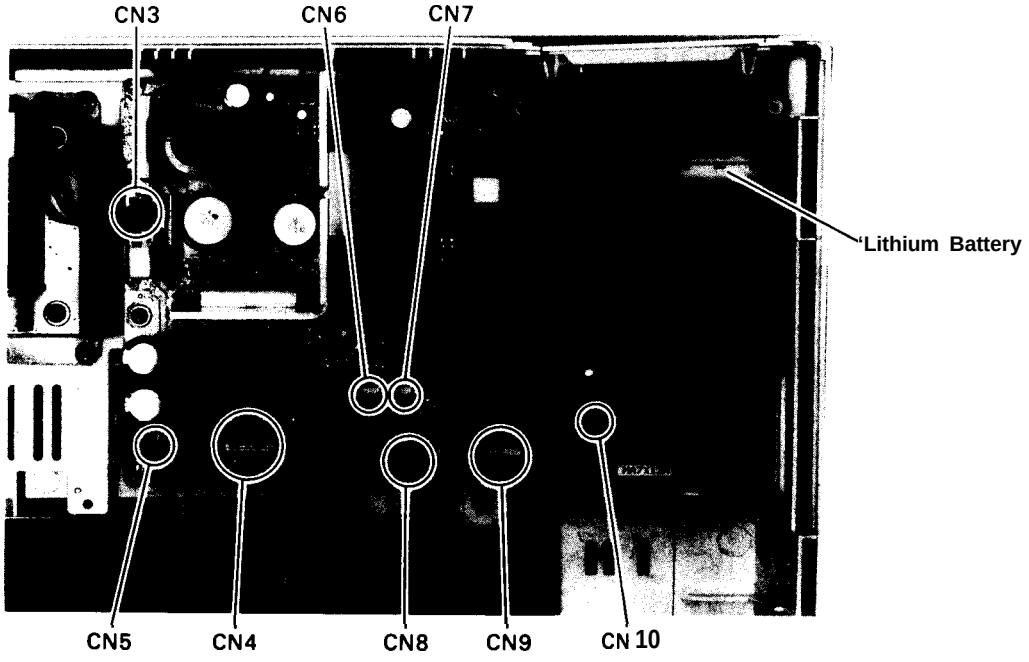


Figure 4-10. Connectors Removal

Step 5: Remove the shield plate at the back of the lower case.

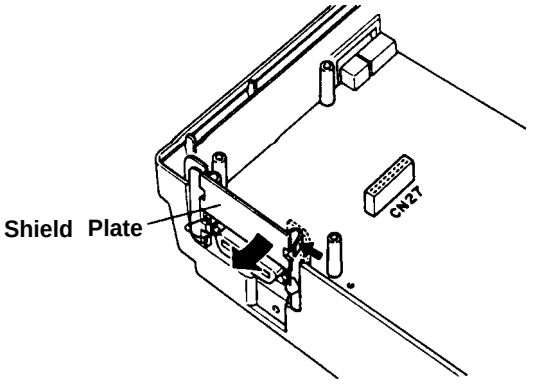


Figure 4-11. Shield Plate Removal

Step 6: Remove the two CBS (3 X 10) and CBB (3 X 12) screws securing the PEGX board.
Step 7: Release four tabs securing the PEGX board.
Step 8: Remove the PEGX board.

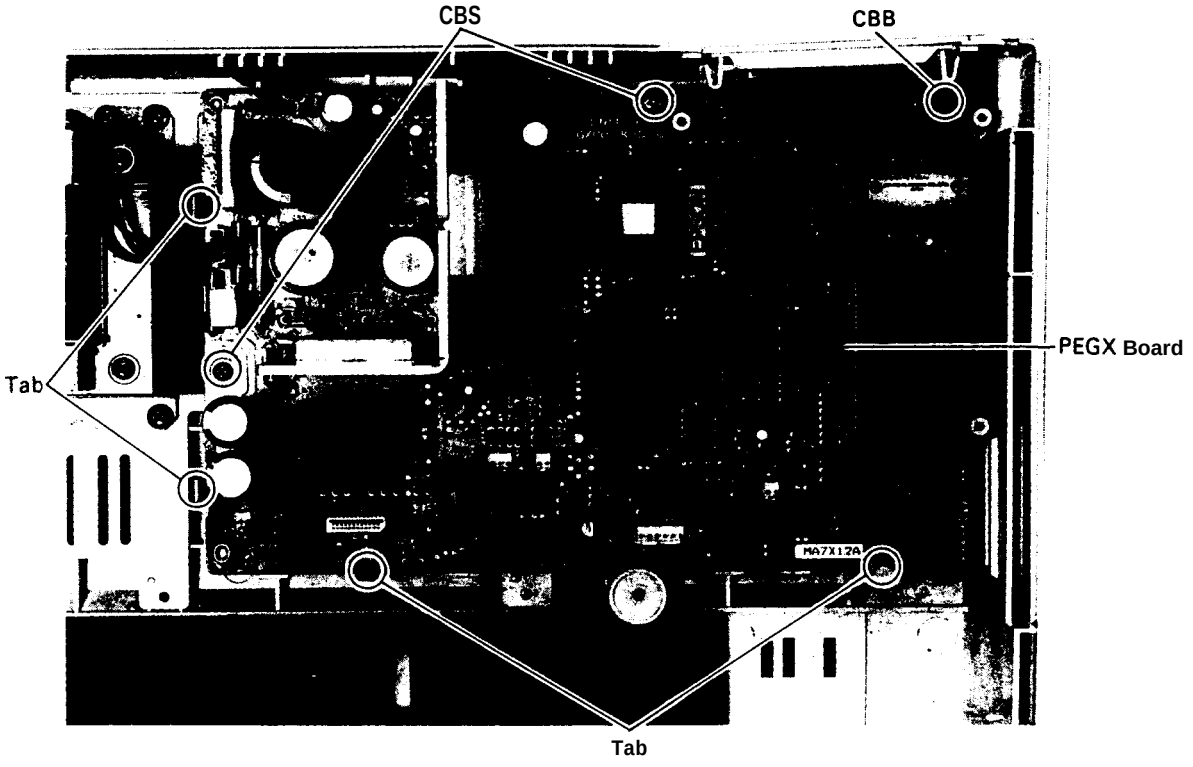


Figure 4-12. PEGX Board Removal

4.2.4.2 PEBFIL-II Board Removal

Step 1: Remove the upper case (Refer to Section 4.2. I.).

Step 2: Disconnect connector CN 1 which connects the PEBFIL-II board.

Step 3: Remove grounding screw CPS (0) (3 X 6) which secures the PEBFIL-II board.

Step 4: Remove grounding screw CB (0) (4 X 8) which secures the A.C ground wire.

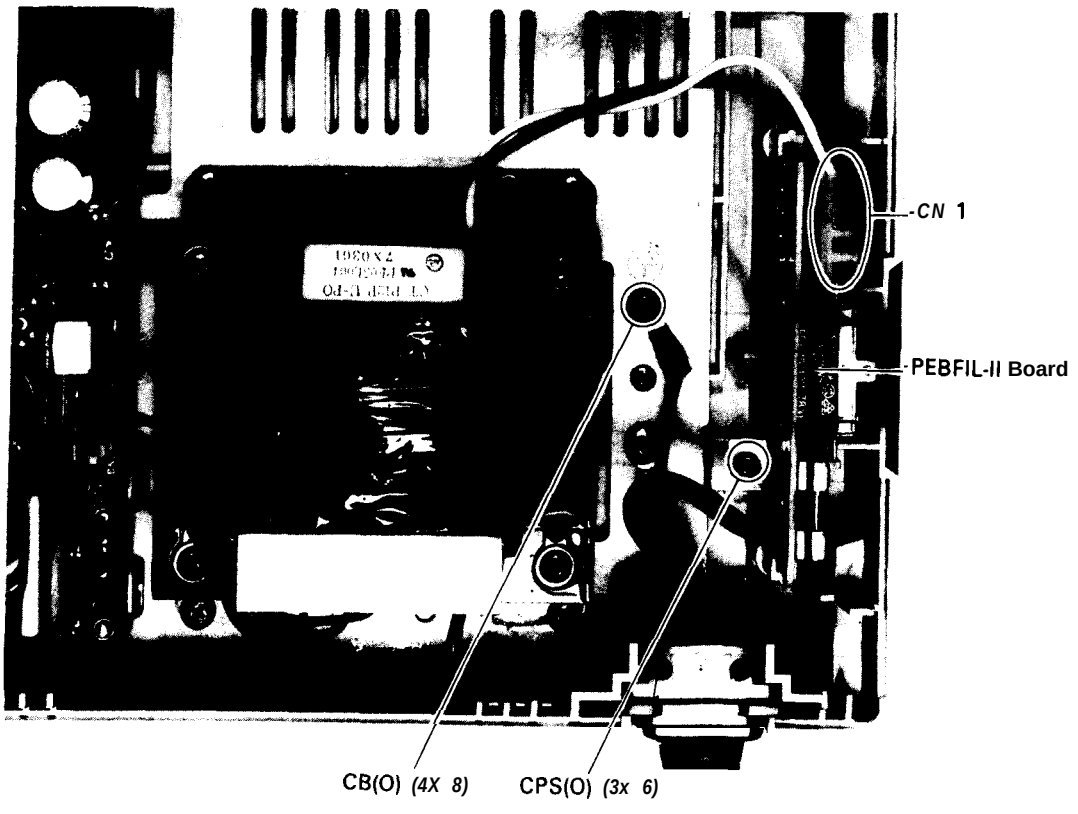


Figure 4-13. PEBFIL-II Board Removal

4.2.5 Printer Mechanism Disassembly

This section describes the procedures for disassembling the main components of the printer mechanism. Figure 4-14 shows the relationship of the printer mechanism's major components for reference during assembly.

Refer to Figures A-20 through A-25 in the Appendix during assembly.

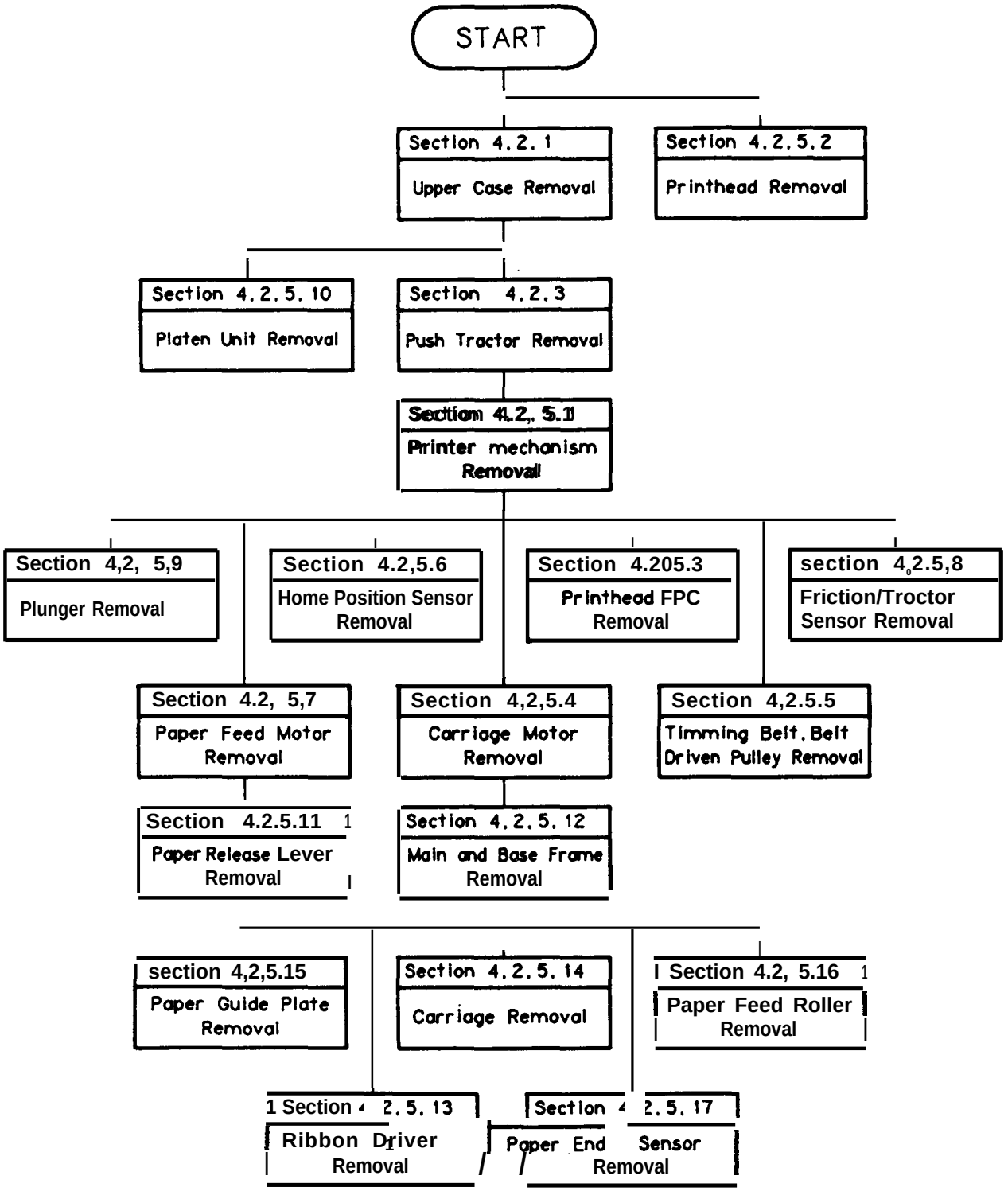


Figure 4-14. Printer Mechanism's Component Relationship

4.2.5.1 Printer Mechanism Removal

Step 1: Remove the upper case (Refer to Section 4.2. 1.).

Step 2: Remove the push tractor unit (Refer to Section 4.2.3.).

Step 3: Disconnect connectors CN4, CN5, CN6, CN7, CN8, CN9, and CN10 from the PEGX board (Refer to Figure 4-1 O.).

Step 4: For the FX-850 remove the three screws, or for the FX-1 050 remove the four screws, CPS(O) (3 X 6), which attach the ground plates to base frame.

Step 5: For the FX-850 remove the four screws, or for the FX-105O remove the five screws, CBB (0) (4 X 25), securing the printer mechanism to the lower case.

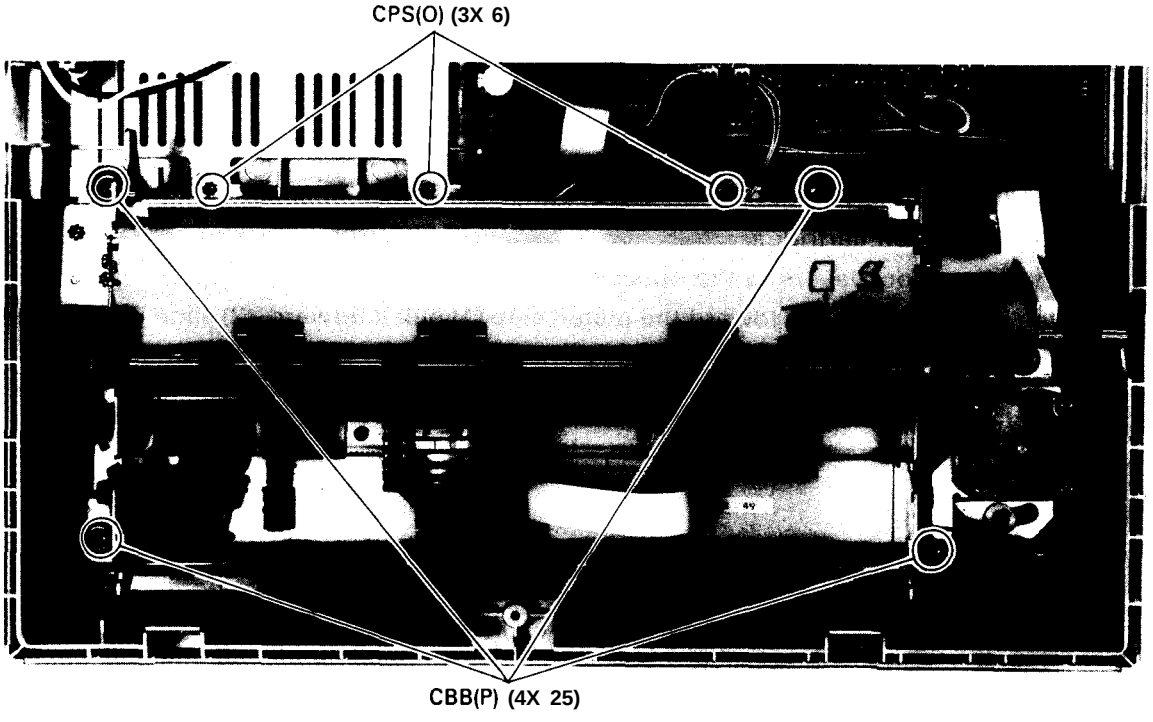


Figure 4-15. Printer Mechanism Removal

Step 6: Remove the printer mechanism from the lower case.

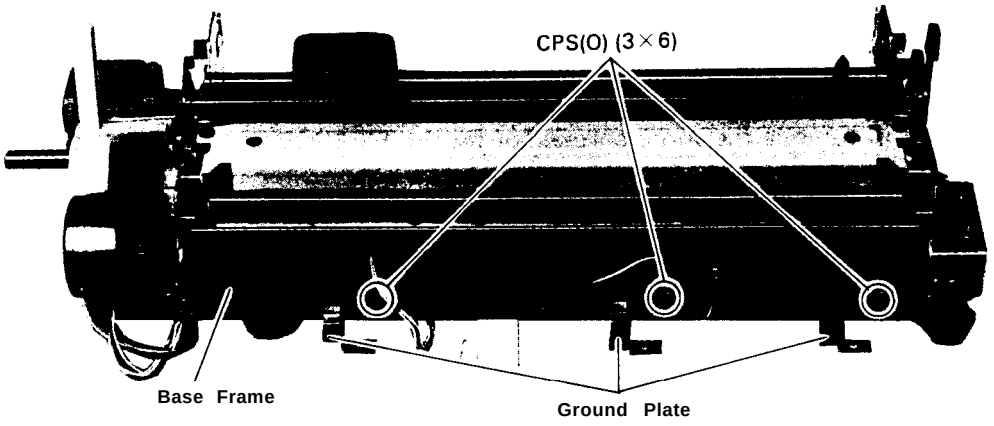


Figure 4-16. Ground Plates Removal

4.2.5.2 Printhead Removal

Step 1: Remove the printer cover.

Step 2: Remove the ribbon cartridge.

Step 3: Move the head lock levers to the outside.

Step 4: Shift the printhead slightly toward the platen side (1) pull it upward, (2) slide it to the right, and (3) remove from the carriage.

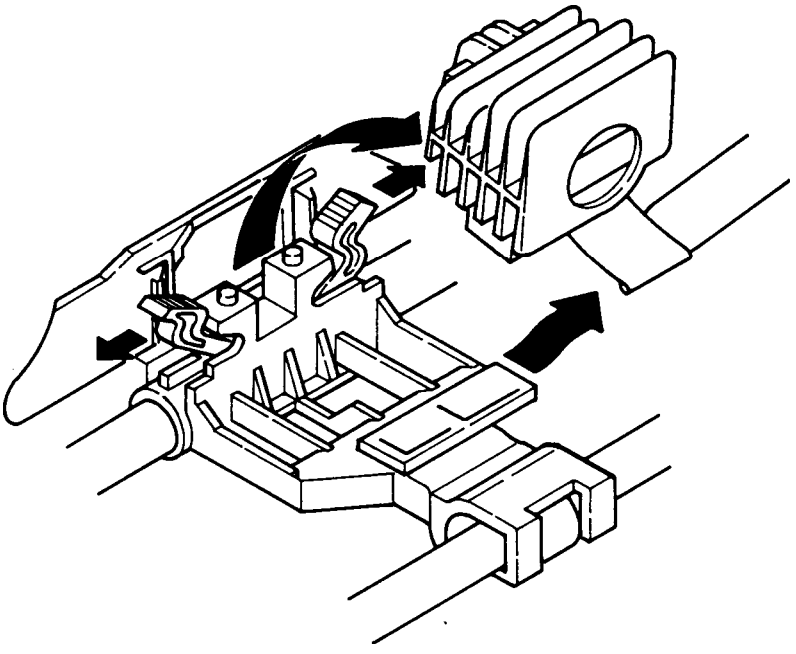


Figure 4-17. Printhead Removal

Step 5: Disconnect the flexible printed cable (FPC) from the connector at the printhead.

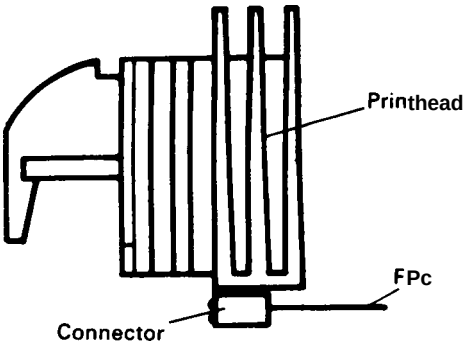


Figure 4-18. Disconnecting FPC

4.2.5.3 FPC (Flexible Printed Cable) Removal

Step 1: Remove the printer mechanism (Refer to Section 4.2.5.1 .).

Step 2: Remove the printhead (Refer to Section 4.2.5.2.).

Step 3: Remove the FPC at the bottom of the base frame.

Step 4: Press the two tabs for the head cable guide at the bottom of the base frame, and remove the head cable holder.

Step 5: Remove FPC.

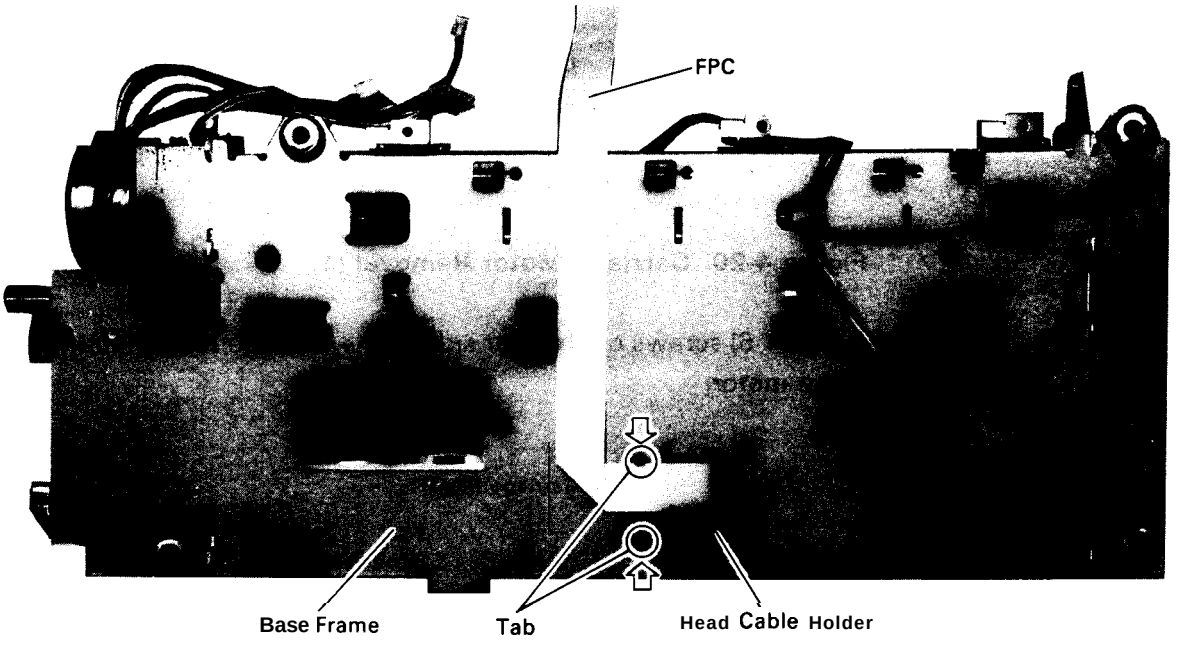


Figure 4-19. FPC Removal

ASSEMBLY POINT

The FPCs are taped to the base frame with a double-sided adhesive tape. Before retaping the FPC to the base frame, use alcohol to clean the area where the adhesive stuck the FPC to the base frame.

4.2.5.4 Carriage Motor Removal

Step 1: Remove the printer mechanism (Refer to Section 4.2.5. 1.).

Step 2: Remove the carriage motor wires from the wire holder.

Step 3: Remove the timing-belt tension spring.

Step 4: Remove the two CPS (0) (3 X 10) screws securing the carriage motor mounting plate to base frame via carriage motor mounting bush.

Step 5: Remove the carriage motor mounting plate together with the carriage motor.

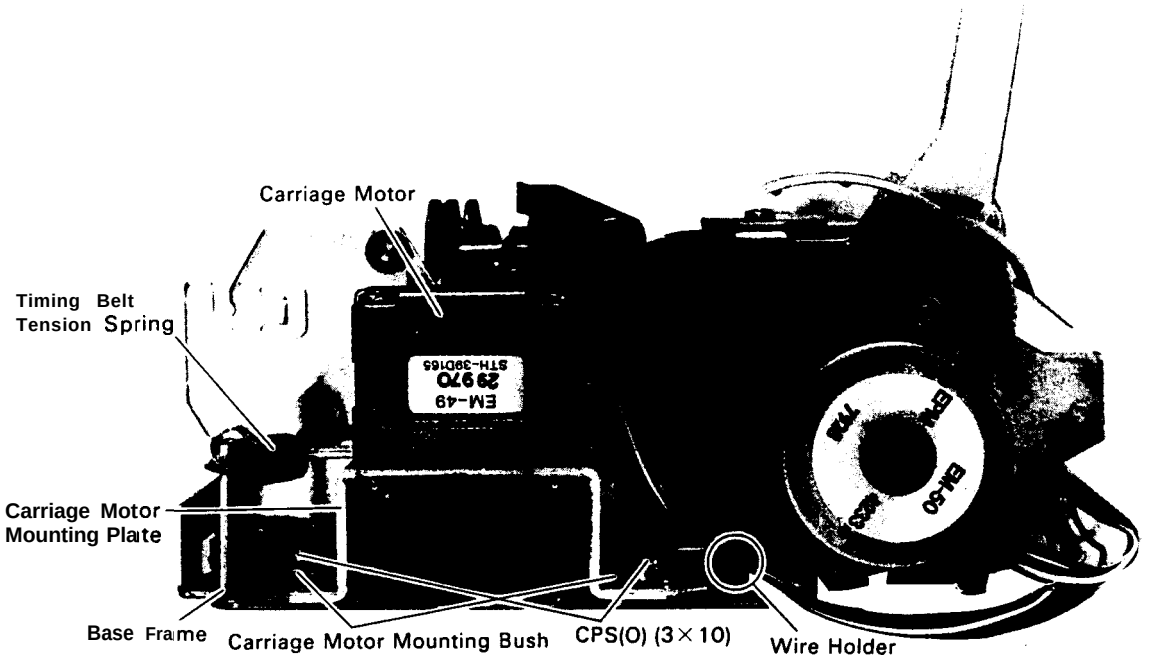


Figure 4-20. Carriage Motor Removal (1)

Step 6: Remove the four CPS(O) (3 X 6) screws on the rear side of the carriage motor mounting plate, which secure the carriage motor.

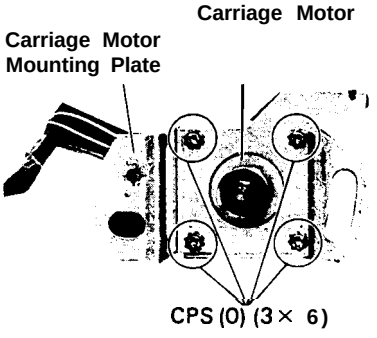


Figure 4-21. Carriage Motor Removal (2)

ASSEMBLY POINT

1. **Set the timing belt correctly at the drive pulley of the carriage motor.**
2. **Mount the carriage motor with carriage motor mounting plate and carriage motor mounting bushes on base frame by lightly tightening two CPS (0) (3 X 10) screws.**
3. **Attach the timing-belt tension spring to hooks on both the base frame and carriage motor mounting plate.**
4. **Tighten the screws on the carriage motor mounting plate.**

4.2.5.5 Timing Belt· Belt-Driven Pulley Removal

Stepl: Remove the printer mechanism (Refer to Section 4.2.5. 1.).

Step2: Remove the timing-belt tension spring.

Step3: Loosen the two CPS(O) (3 X 10) screws which fixing carriage motor mounting plate to the base frame.

Step4: Pull the timing belt out from carriage motor pulley.

Step5: Place the carriage over the notch in right side of the base frame, and release the engaged parts of the timing belt and carriage from the bottom side of the base frame.

Step 6: Remove the belt-driven pulley by moving it to the left, and remove the timing belt.

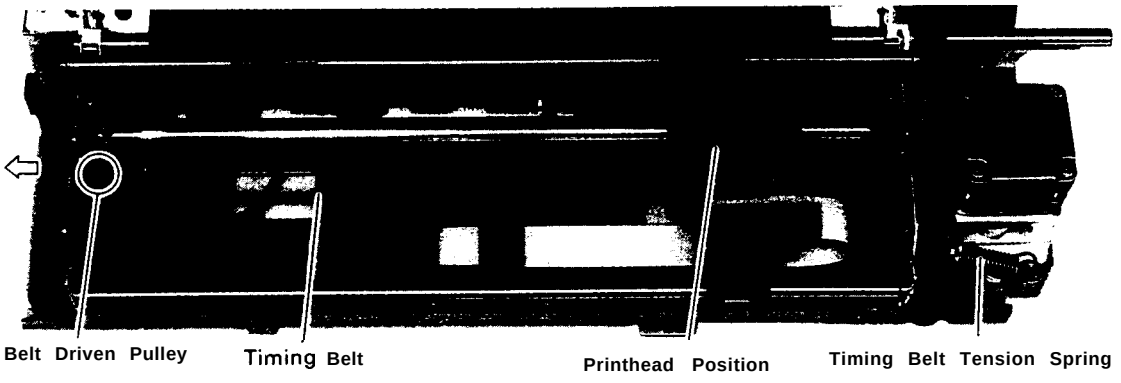


Figure 4-22. Timing Belt Removal

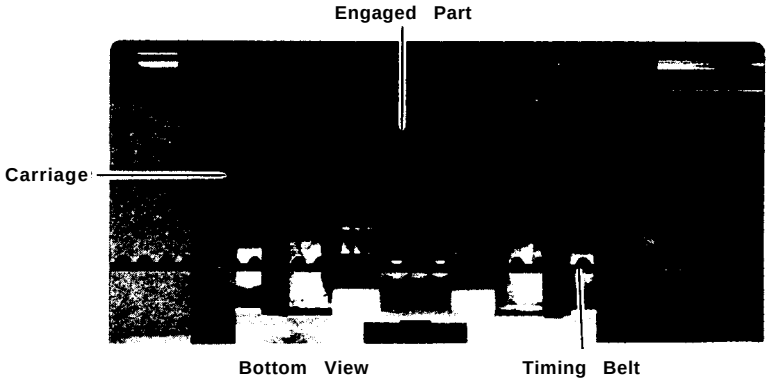


Figure 4-23. Timing Belt Insertion

ASSEMBLY POINTS

1. **Verify that the timing belt runs around the belt-driven pulley and the belt-driving pulley of the carriage motor shaft.**
2. **Insert the timing belt firmly into the carriage, utilizing the notch in the base frame, in the same way as when removing it. After insertion, apply adhesive at the engaged parts of the carriage and the belt (Refer to Section 6.2, Lubrication and Adhesive Application.). Insert the belt until the undersurfaces of the belt mesh with the inserted parts of the carriage.**
3. **Hang the timing-belt tension spring on hooks for both base frame and carriage motor mounting plate.**
4. **Tighten the screws on the carriage motor mounting plate.**

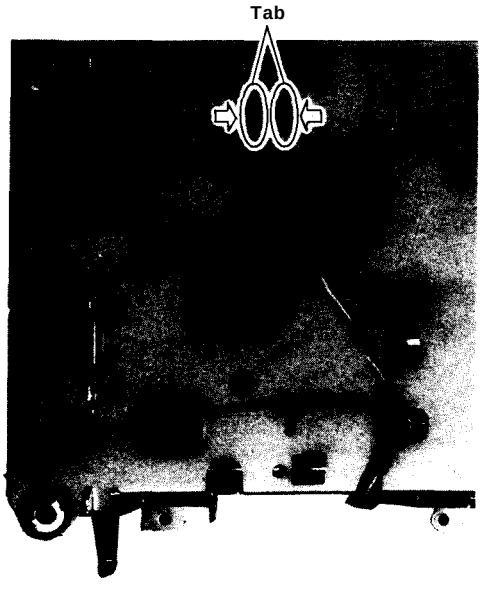
4.2.5.6 Home Position Sensor Removal

Step 1: Remove the printer mechanism (Refer to Section 4.2.5. 1.).

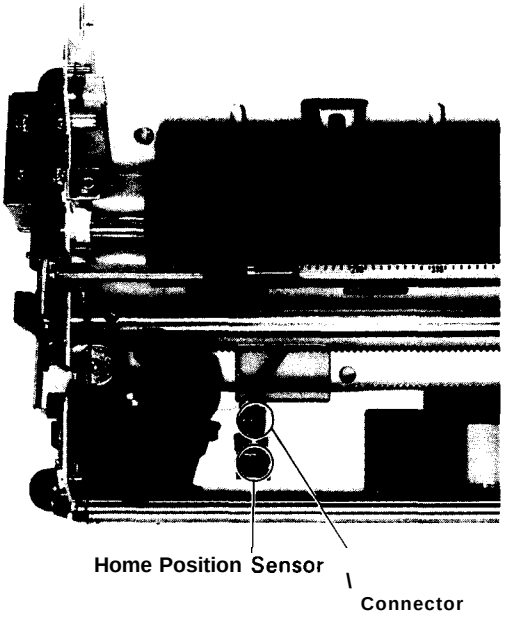
Step 2: Press the two tabs of the home position sensor on the bottom of the base frame.

Step 3: Remove the home position sensor.

Step 4: Disconnect the connector from the home position sensor.



(a) Bottom View



(b) Top View

Figure 4-24. Home Position Sensor Removal

4.2.5.7 Paper Feed Motor" Transmission Gears Removal

Step 1: Remove the printer mechanism (Refer to Section 4.2.5.1.).

Step 2: Remove the two CPS(O) (3 × 6) screws.

Step 3: Remove the paper feed motor.

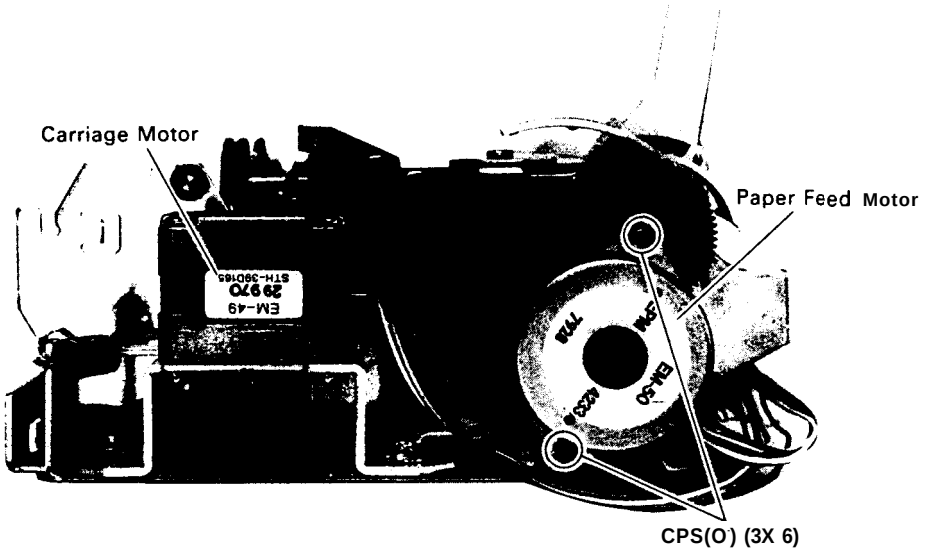


Figure 4-25. Paper Feed Motor Removal

Step 4: Remove the tractor transmission gear spring.

Step 5: Remove the paper feed transmission gear.

Step 6: Remove the PW (5.2 X 0.3 X 10) and tractor transmission gear.

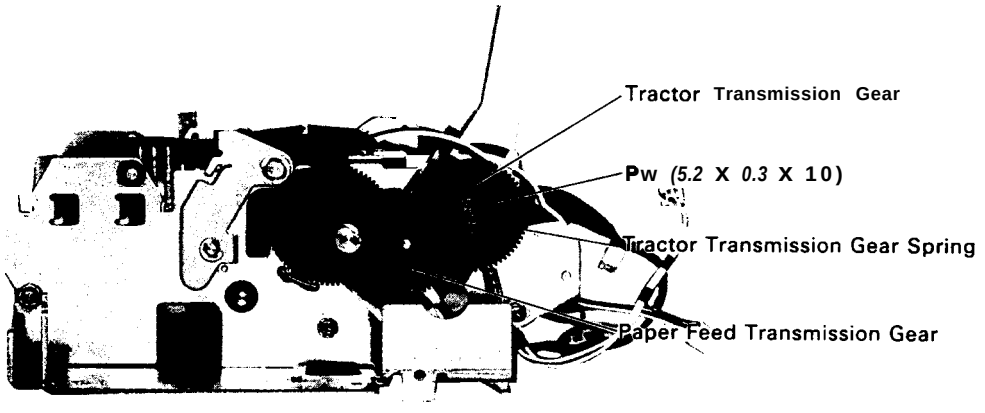


Figure 4-26. Transmission Gears Removal

ADJUSTMENT REQUIRED

When the paper feed motor is replaced or the fixing screws are loosened, perform the following adjustment: 4.3.2. Paper Feed Motor Gear Backlash Adjustment.

4.2.5.8 Friction/Tractor Sensor Removal

Step 1: Remove the printer mechanism (Refer to Section 4.2.5. 1.).

Step 2: Position the paper release lever at its back setting.

Step 3: Remove the paper feed motor (Refer to Section 4.2.5.7).

Step 4: Remove the CPS(P) (3 X 10) screw securing the friction/tractor sensor to the side frame R, then remove the sensor.

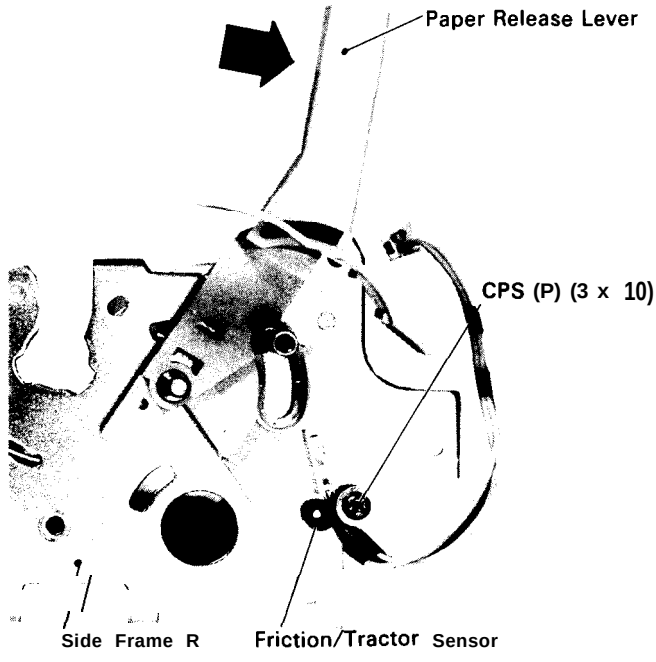


Figure 4-27. Friction/Tractor Sensor Removal

ASSEMBLY POINT

Make sure of the sensor direction and set in place before mounting the friction/tractor sensor on the side frame R.

4.2.5.9 Plunger Removal

Step 1: Remove the printer mechanism.

Step 2: Remove the RE (3), and disconnect loading lever of the plunger from the paper holding lever L.

Step 3: Remove two CPS (0)(3 × 6) screws, which secure the plunger to the side frame L, then remove the plunger.

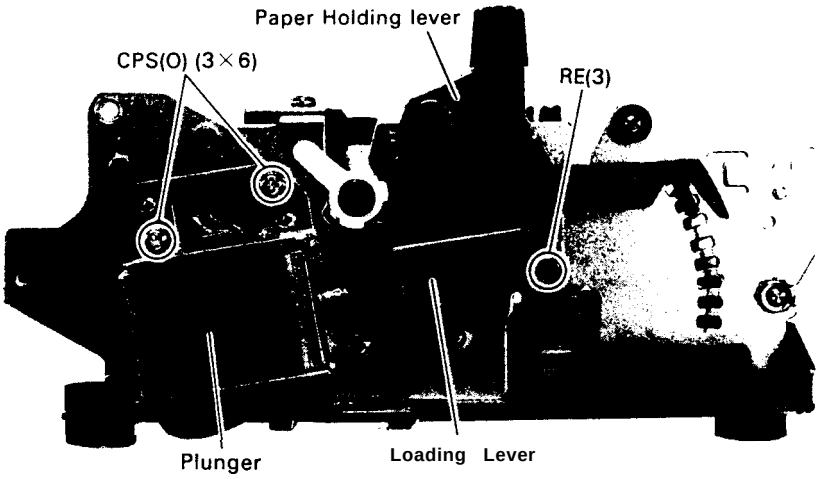


Figure 4-28. Plunger Removal

ASSEMBLY POINTS

1. Mount plunger on side frame L by tightening the two CPS (0) (3 X 6) screws lightly.

2. Set loading lever onto paper holding lever L, and put on RE (3).

3. Hold the pulnger and cylinder as shown in Figure 4-29, and position it where move smoothly the cylinder, and tight screws.

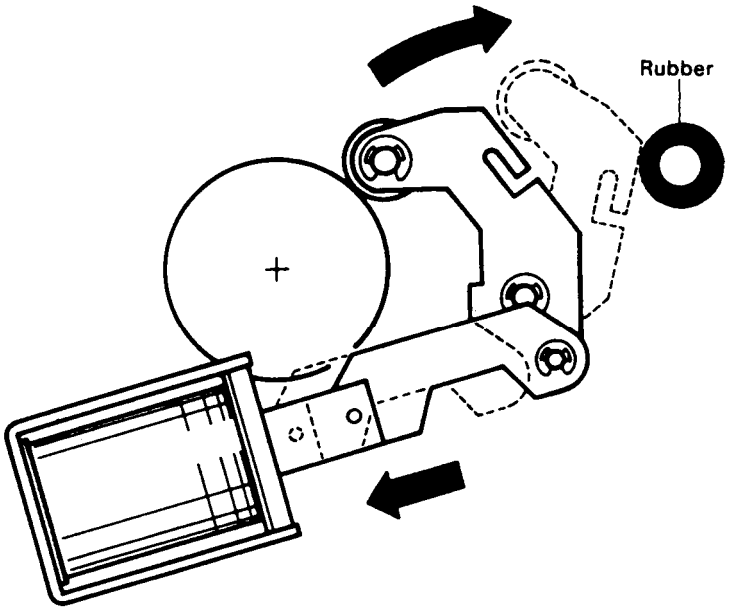


Figure 4-29. Plunger Positioning

4.2.5.10 Platen Unit Removal

Step 1: Remove the upper case (Refer to Section 4.2.1.).

Step 2: Remove the two CBNS (3 × 6) screws securing the platen cover to side frames L and R, then remove the platen cover.

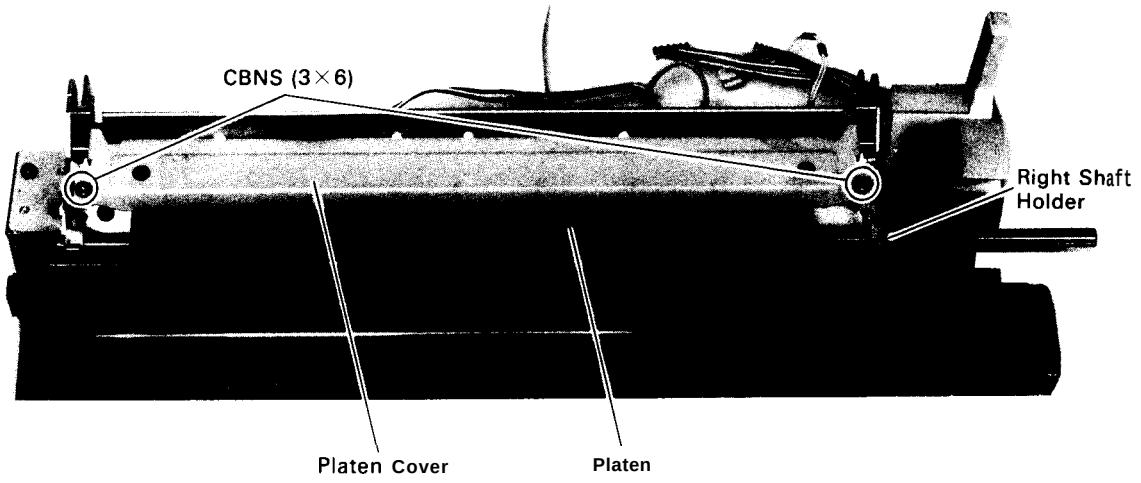


Figure 4-30. Platen Cover Removal

Step 3: Push on the right shaft holder clip, and rotate it forward.

Step 4: Remove the platen unit by moving it to the right side while pulling paper holding roller shaft forward.

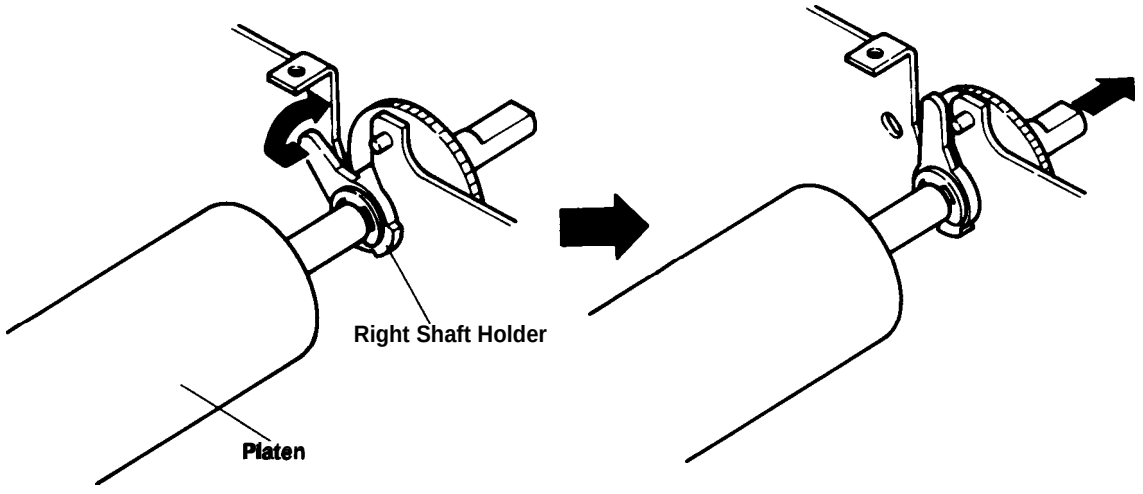


Figure 4-31. Platen Removal

4.2.5.11 Paper Release Lever Removal

Step 1: Remove the printer mechanism (Refer to Section 4.2.5.1.).

Step 2: Remove the paper feed motor and transmission gears (Refer to Section 4.2.5.7.).

Step 3: Remove the platen unit (Refer to Section 4.2.5. 10.).

Step 4: Press the paper release lever tab at the inside of the side frame R, then remove the lever.

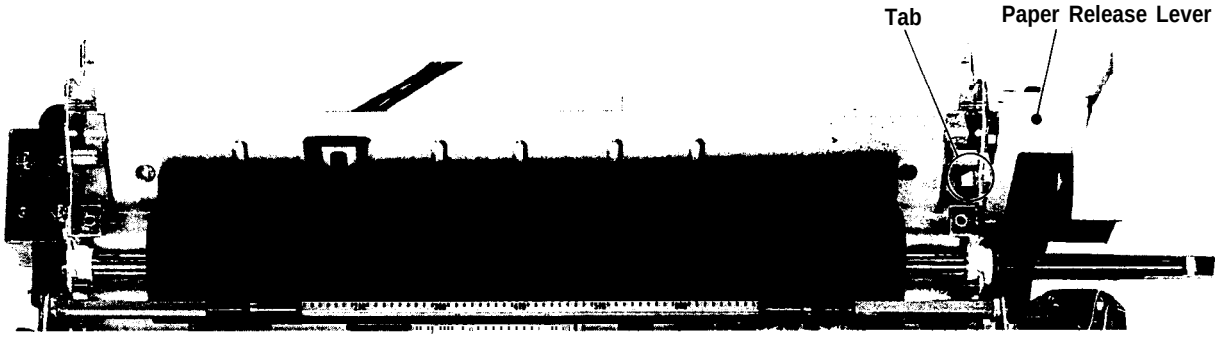


Figure 4-32. Paper Release Lever Removal

4.2.5.12 Main and Base Frame Removal

Step 1: Remove the printer mechanism (Refer to Section 4.2.5.1.).

Step 2: Remove the printhead (Refer to Section 4.2.5.2.).

Step 3: Remove the carriage motor (Refer to Section 4.2.5.4.).

Step 4: Remove the belt-driven pulley (Refer to Section 4.2.5.5.).

Step5: Remove the paper feed motor (Refer to Section 4.3.5.7).

Step 6: Cut wire clamps fix cables to the base frame.

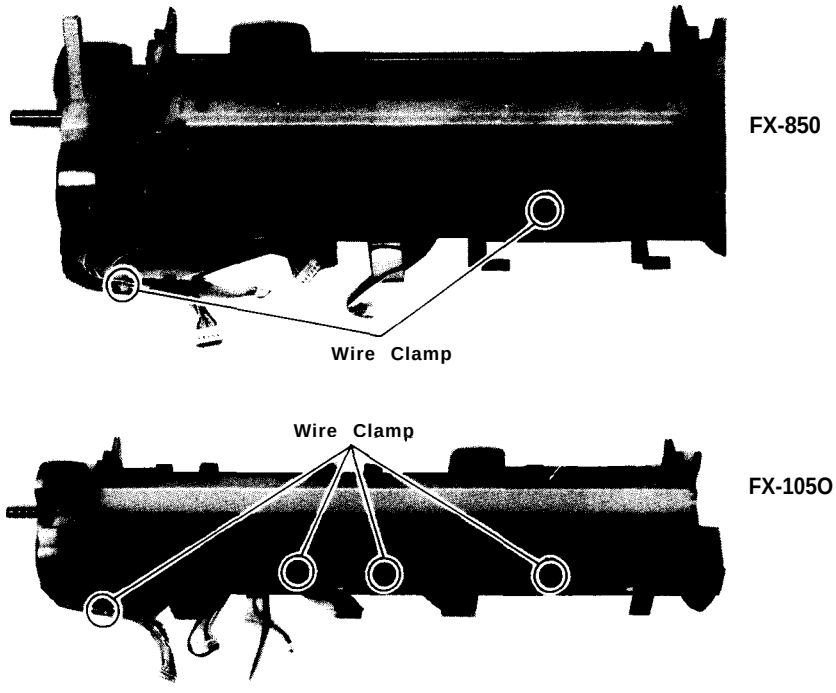


Figure 4-33. **Wire Clamp Positions**

Step 7. Remove the home position sensor and plunger cables from the base frame.

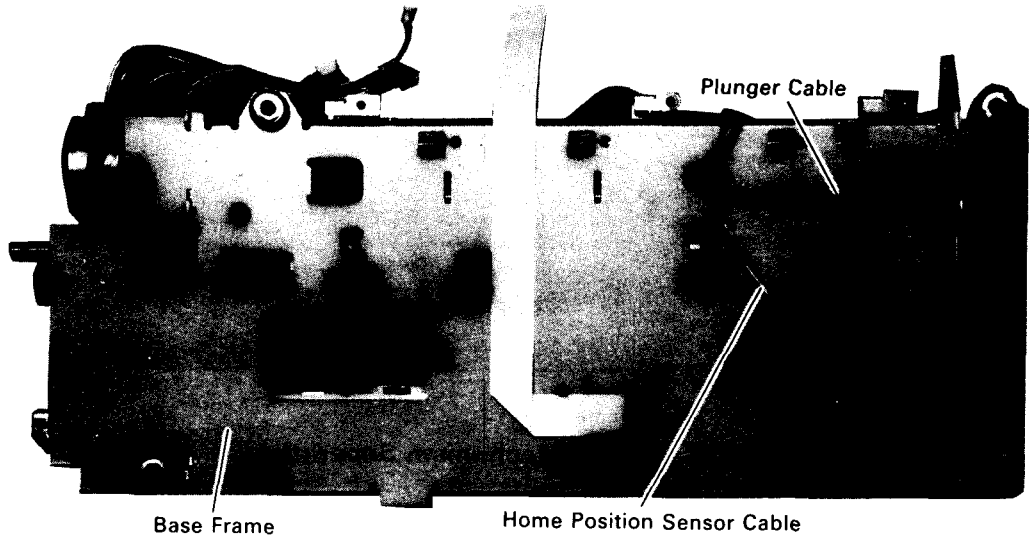


Figure 4-34, Cable Positions on the Base Frame

Step 8 : Remove two CPS (0) (3 × 10) screws securing both side frames L and R to the base frame.

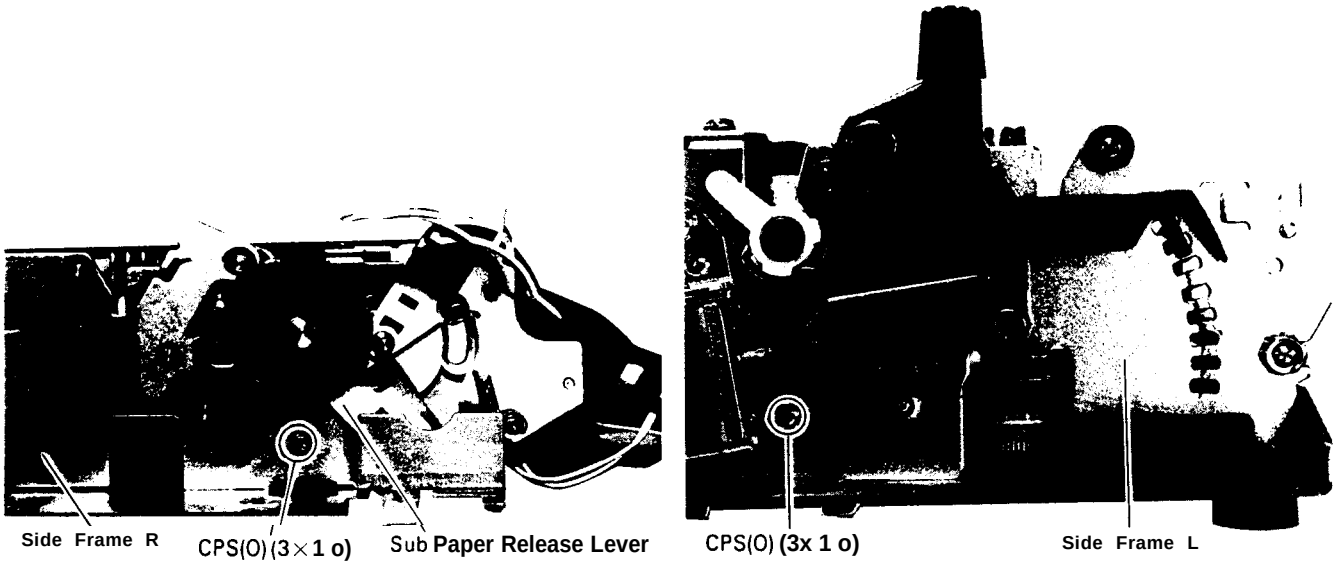


Figure 4-35. Side Frame Screws Removal

Step 9 : Remove the sub paper release lever from the side frame R (See Figure 4-35.).

Step 10: Detach the hooks on the main unit from the base frame, and pull the main unit up.

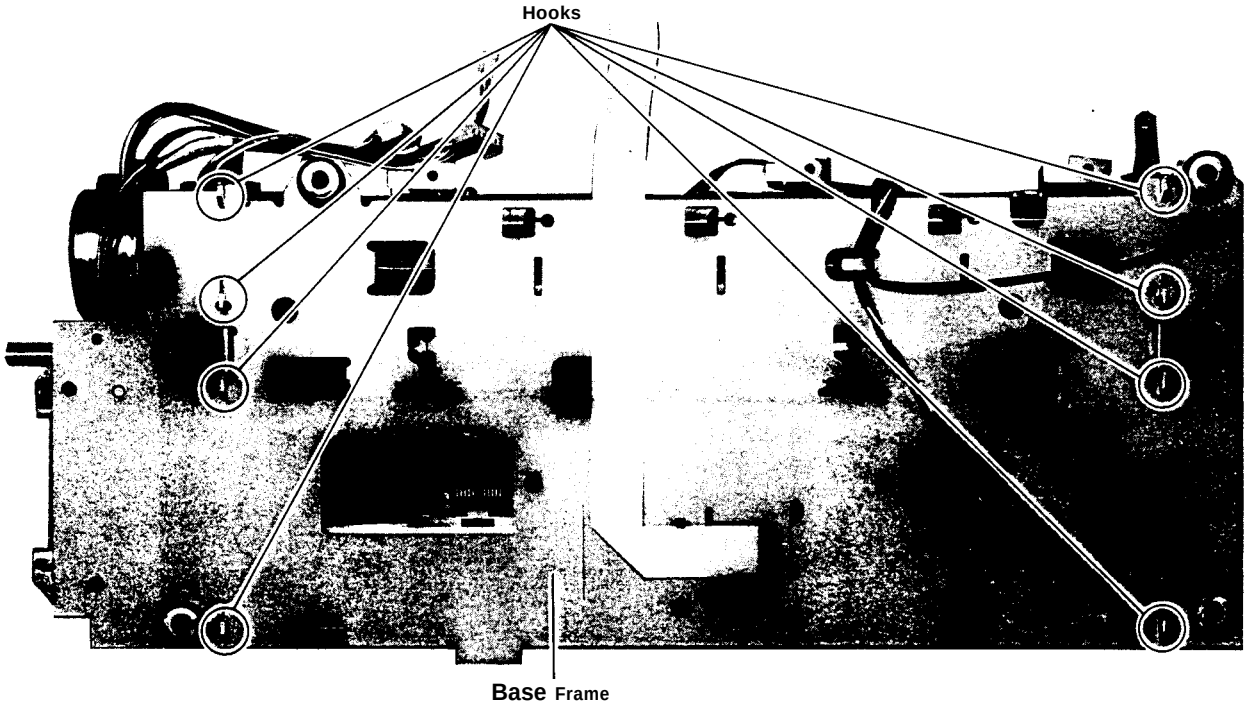


Figure 4-36. Printer Mechanism Separation,

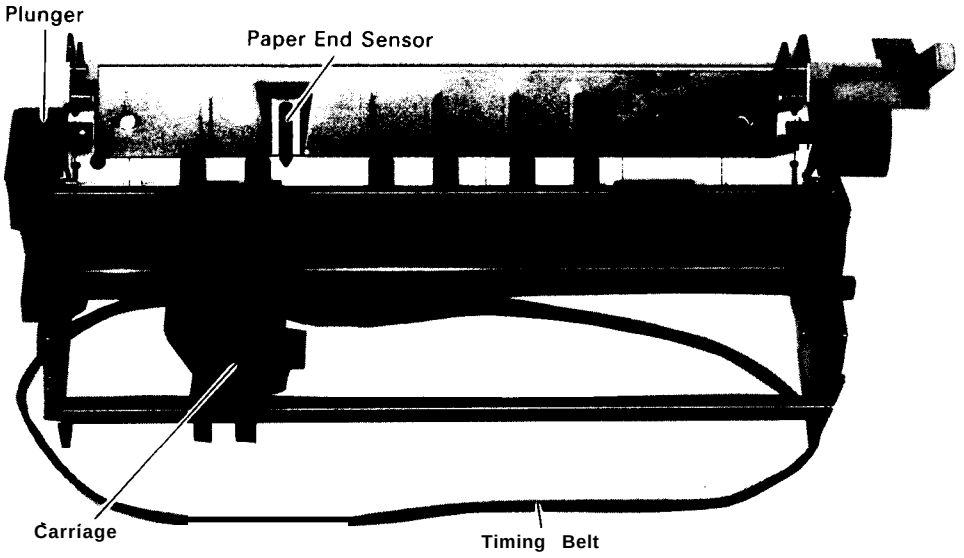


Figure 4-37. Main Frame Unit

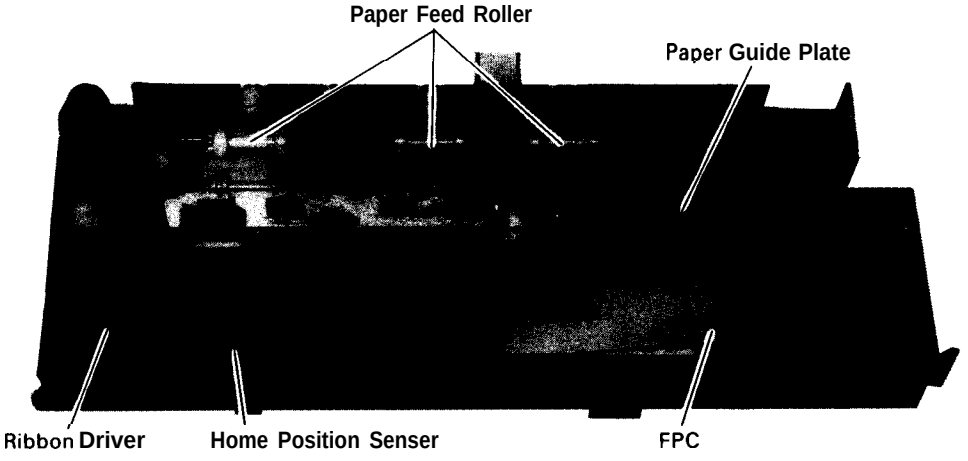


Figure 4-38. Base Frame Unit

ASSEMBLY POINT

When fitting the main frame to the base frame, hook the eight tabs into the holes in the base frame, and pull it forward.

ADJUSTMENTS REQUIRED

The following adjustment is required to reassemble the printer mechanism:

4.3.2 Paper Feed Motor Backlash Adjustment

4.2.5.13 Ribbon Driver Unit Removal

Step 1: Remove the printer mechanism (Refer to Section 4.2.5. 1.).

Step 2: Separate the main and base frame units (Refer to Section 4.2.5.1 2.).

Step 3: Press the six tabs for the ribbon driver unit at the bottom of the base frame, and remove it.

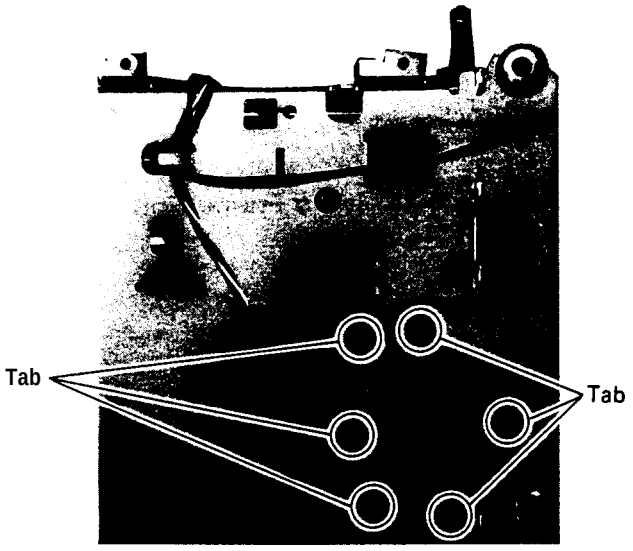


Figure 4-39. Ribbon Driver Unit Removal

4.2.5.14 Carriage Removal

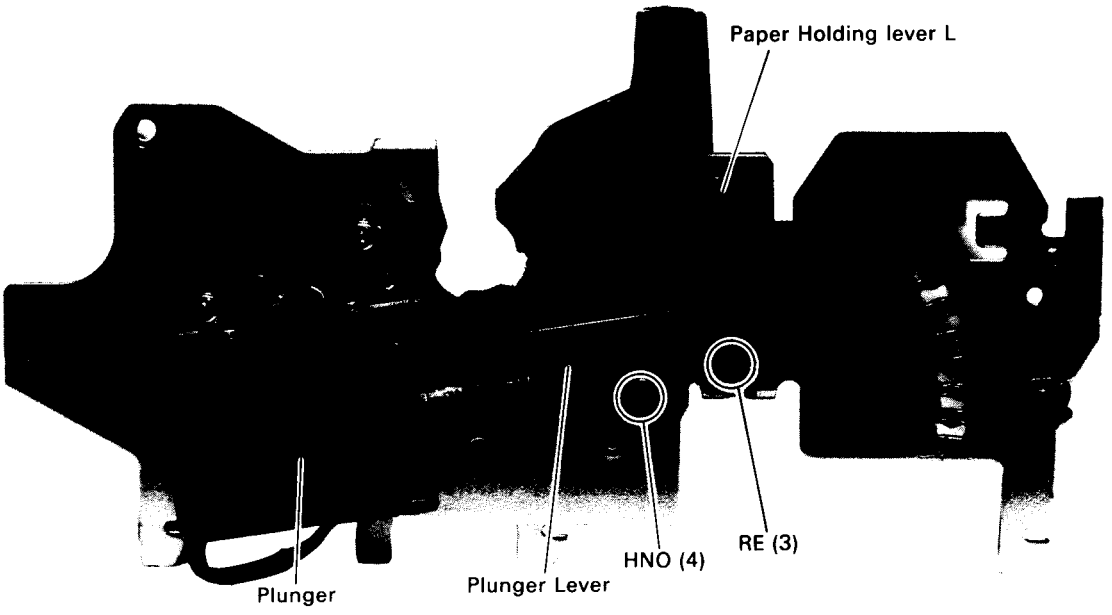
Step 1: Remove the printer mechanism (Refer to Section 4.2.5. 1.).

Step 2: Separate the main and the base units (Refer to Section 4.3.5.1 1).

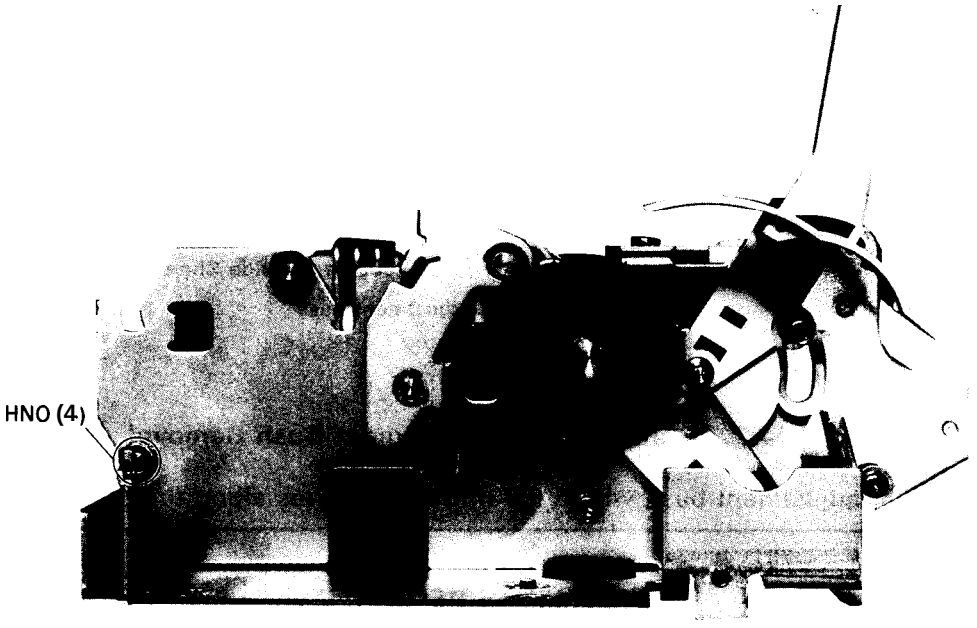
Step 3: Remove the RE (3) securing the loading lever of the plunger to paper holding lever L.

Step 4: Remove the two HNO (4) nuts from the side frame L.

Step 5: Remove the HNO (4) nut from the side frame R.



(a) Left Side View



(b) Right Side View

Figure 4-40. Carriage Removal

Step *6:* **Spread both frames L and R apart, and remove the carriage guide shafts A and B.**

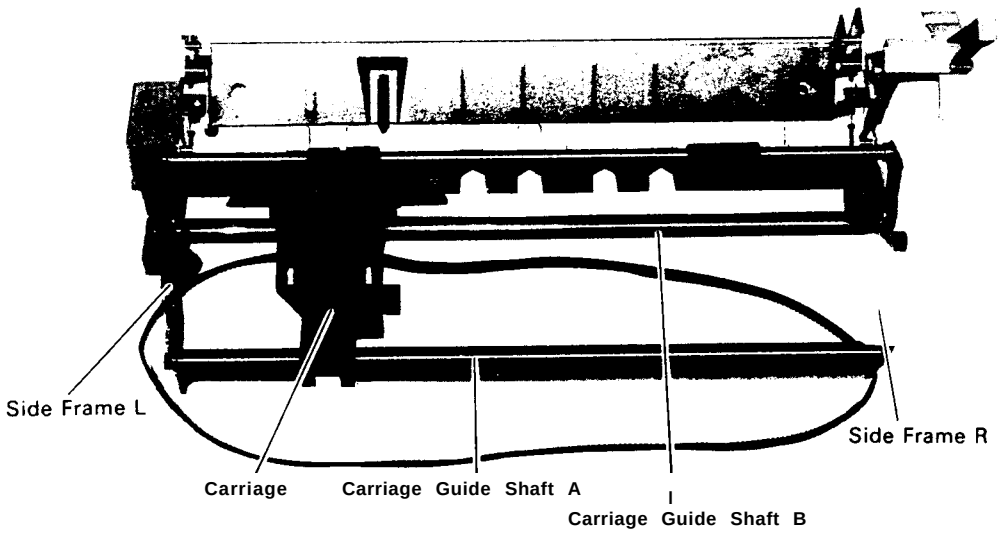


Figure 4-41. Carriage Guide Shafts A and B Removal

Step 7: Pull the carriage out from the carriage guide shafts A and B.

ASSEMBLY POINTS

1. **While passing the carriage guide shaft B through the carriage, fit the felt to the bottom of the carriage.**
2. **Set one LS (6 X 0.15 X 1 1) and the parallel adjustment bush to the right side of the carriage guide shaft B.**

NOTE: LS and parallel adjustment bush has direction, set as shown in Figure 4-42.

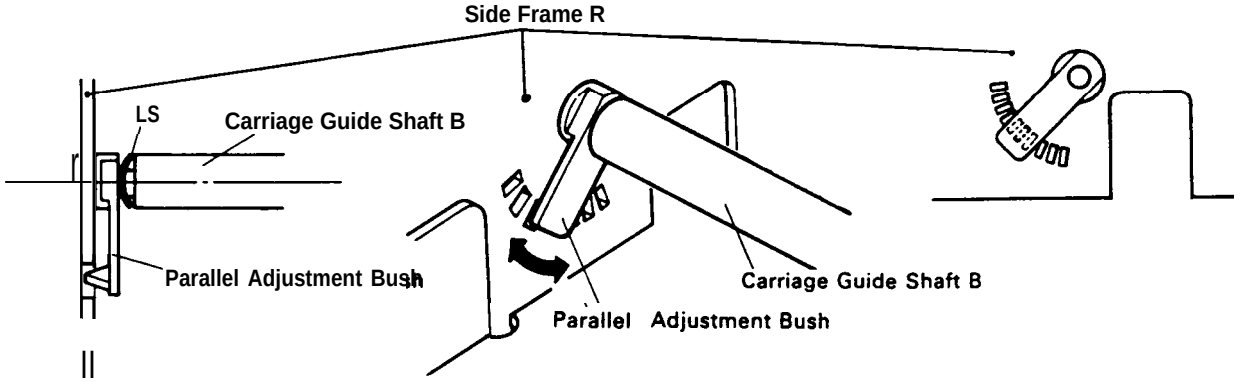


Figure 4-42. LS and Parallel Adjustment Bush Removal

3. **Adjust the parallel adjustment bush where the printhead moves along the platen in parallel.**

ADJUSTMENTS REQUIRED

For assembly, the following adjustments are required:

4.3.1 Platen Gap Adjustment
4.3.2 Paper Feed Motor Backlash Adjustment

4.2.5.15 Paper Guide Plate Removal

Step 1: Remove the printer mechanism (Refer to Section 4.2.5. 1.).

Step 2: Separate the main and base units (Refer to Section 4.2.5.1 l.).

Step 3: For the FX-850, remove the two paper guide plate springs or for the FX-1 050 remove three paper guide plate springs with the mechanism status.

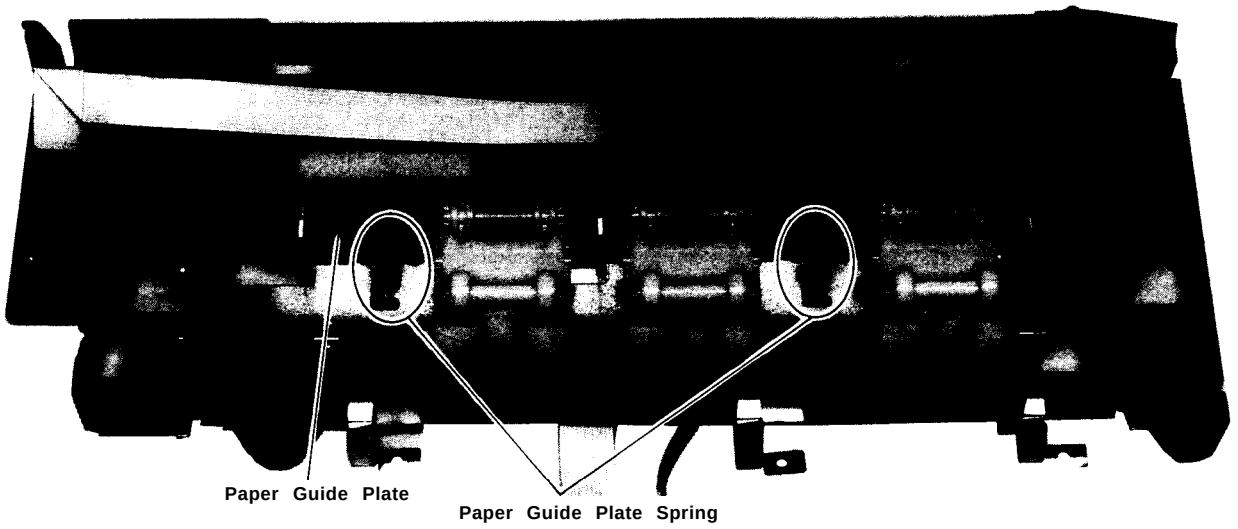


Figure 4-43. Positional Relationship Between Paper Guide Plate and Paper Guide Plate Springs

Step 4: Remove the paper guide plate.

ASSEMBLY POINT

When setting the paper guide plate, verify that its direction is correct.

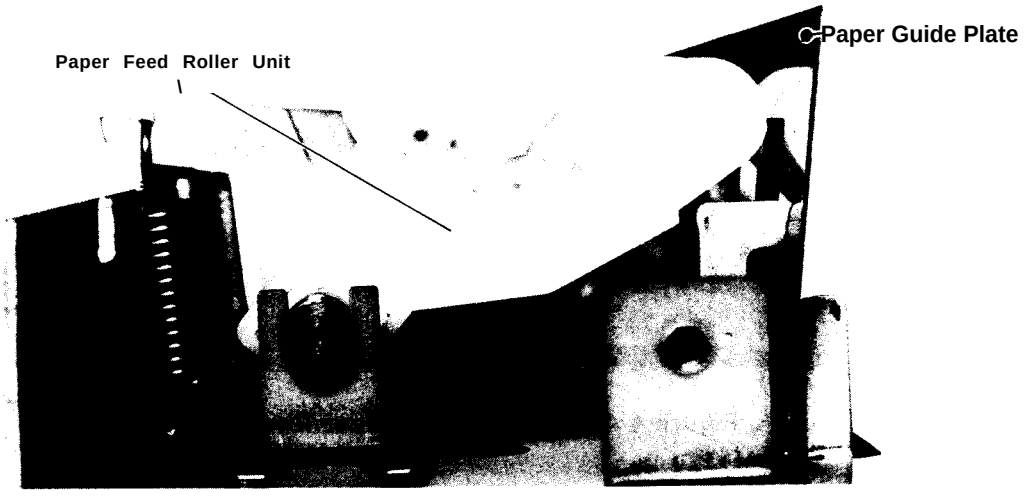


Figure 4-44. Paper Guide Plate and Paper Feed Roller Unit Relationship

4.2.5.16 Paper Feed Roller Unit Removal

Step 1: Remove the printer mechanism (Refer to Section 4.2.5. 1.).

Step 2: Separate the main and base units (Refer to Section 4.2.5.11 .).

Step 3: Remove three paper feed springs for the FX-850 or four for FX-1 050 from the hook on the base frame.

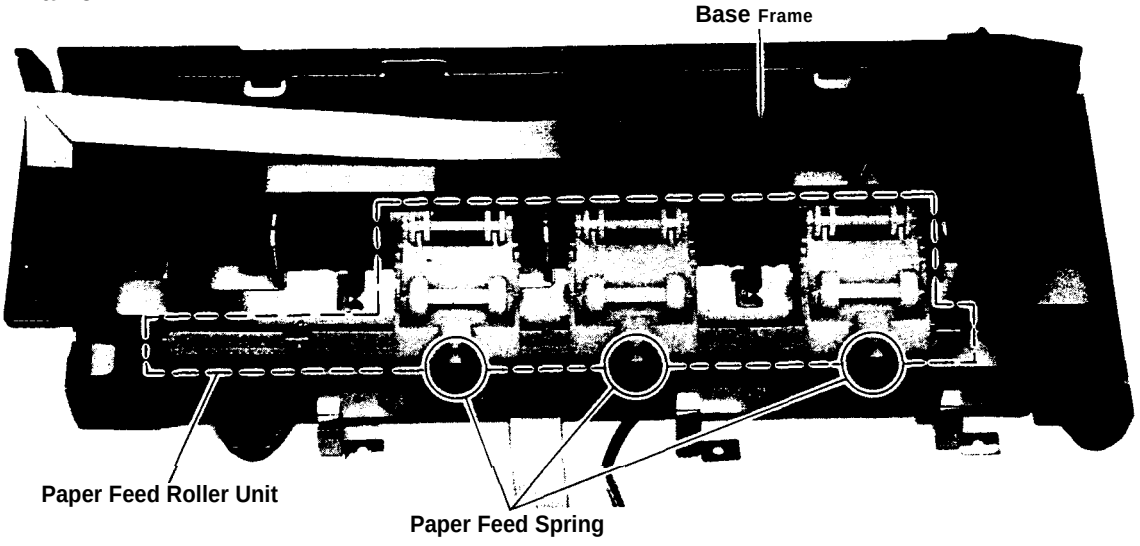


Figure 4-45. Paper Feed Roller Unit Removal

4.2.5.17 Paper End Sensor Removal

Step 1: Remove the printer mechanism (refer to Section 4.2.5. 1.).

Step 2: Separate the main and base units (Refer to Section 4.2.5.11 .).

Step 3: Loosen the two bends securing the paper end sensor to the back of the paper guide.

Step 4: Remove the paper end sensor.

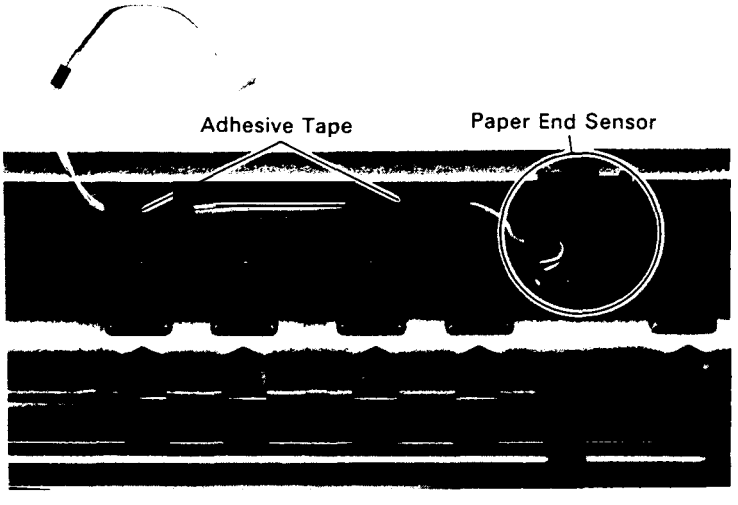


Figure 4-46. Paper End Sensor *Removal*

4.2.5.18 Paper Holding Roller Set and Paper Holding Levers L and R Removal

Step 1: Remove RE (3) at the outside of the paper holding lever R on the paper holding roller set.

Step 2: Remove the right and left end of the paper holding roller shaft from the paper holding levers.

Step 3: Remove the carriage motor (Refer to Section 4.2.5.4.).

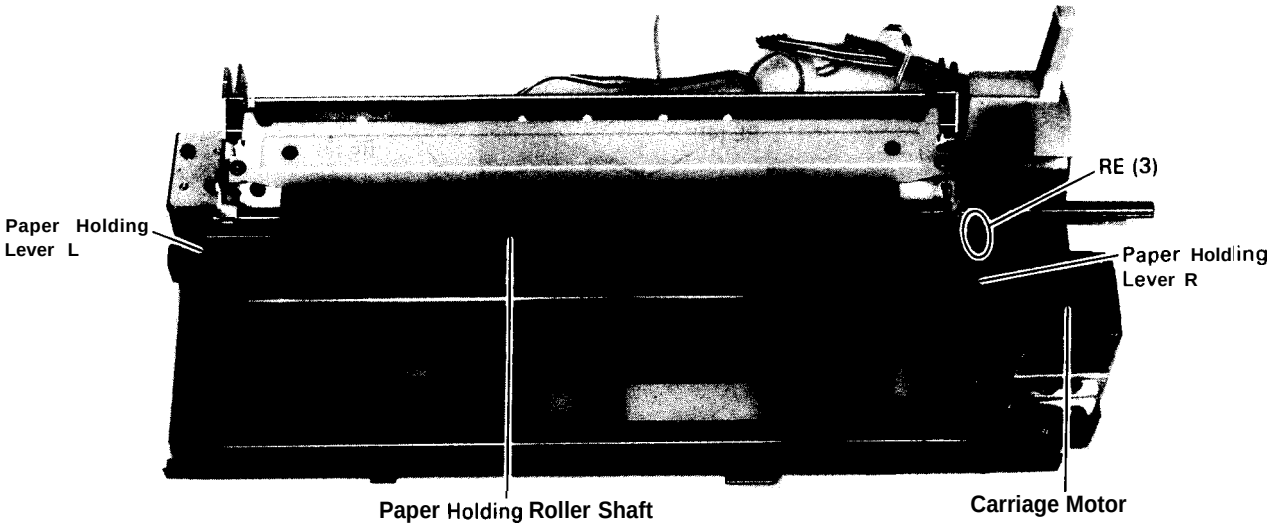


Figure 4-47. Paper Holding Roller Shaft Removal

Step 4: Remove RE (3) at the side frame R (See Figure 4-48.).

Step 5: Detach the paper holding lever R spring from the paper holding lever R.

Step 6: Remove the paper holding lever R.

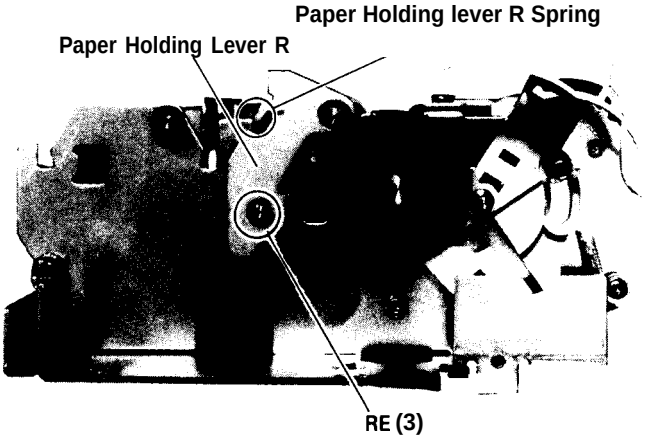


Figure 4-48. Paper Holding Roller Lever R Removal

Step 7: **Remove the RE (2.3) at the plunger lever.**

Step 8: **Remove the RE (3) at the paper holding lever L.**

Step 9: **Remove the HNO (4) nut securing the head adjustment lever to carriage guide shaft B, then remove head adjustment lever.**

Step 10: **Detach the paper holding lever L spring from the paper holding lever L.**

Step 1 1: **Remove the paper holding lever L.**

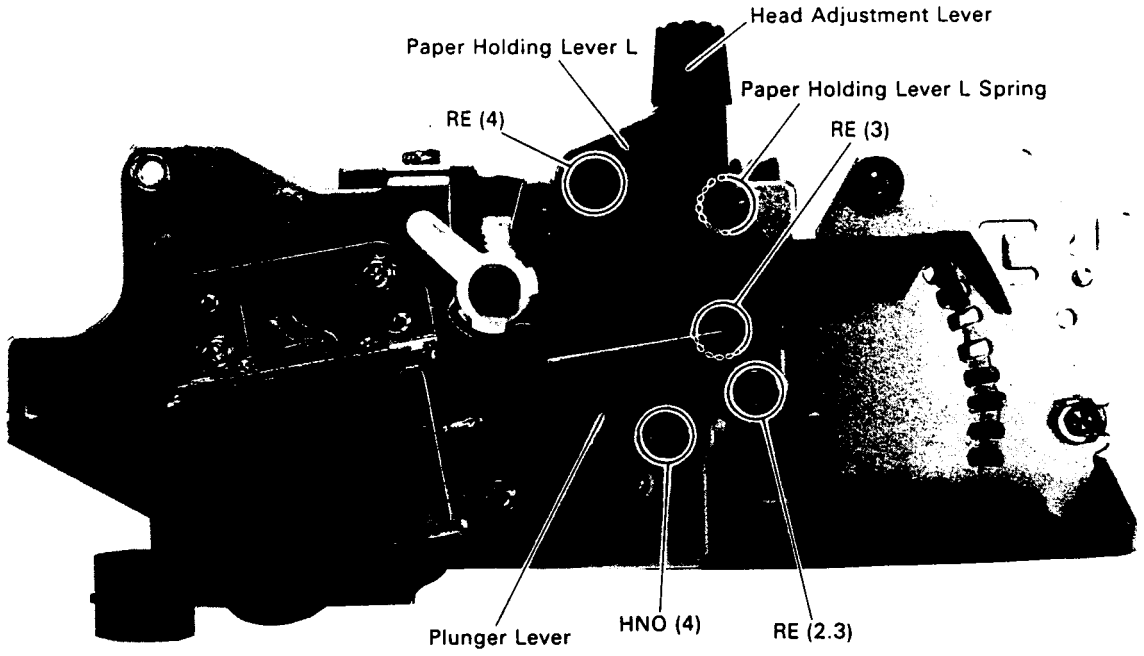


Figure 4-49. Paper Holding Roller Lever L Removal

4.2.5.19 Push Tractor Unit Disassembly

This section describes the removal of the tractor assembly (left). Since disassembled parts can be reassembled by using the removal procedures in reverse order, assembly procedures have been omitted.

Step 1: Remove the shaft holder from the tractor mounting plate L.
Step 2: Remove the CPS (0)(3 X 6) screw securing tractor mounting plate L to the tractor base frame.
Step 3: Remove the HNO (4) nut securing the tractor guide shaft.
Step 4: Remove the tractor side frame L.
Step 5: Push the tractor lock lever upward, and remove the left sprocket assembly from the shafts.

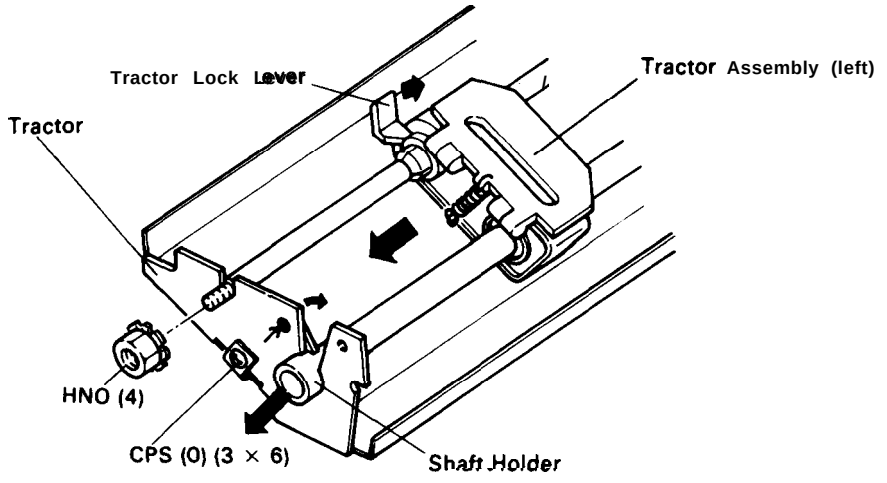


Figure 4-50. Tractor Assembly (left) Removal

ASSEMBLY POINT

When mounting the tractor assemblies to the shafts, set them so that the marks on the right and left tractor frames are at the same position. Make sure that the pins on the right and left tractor belts are aligned in parallel.

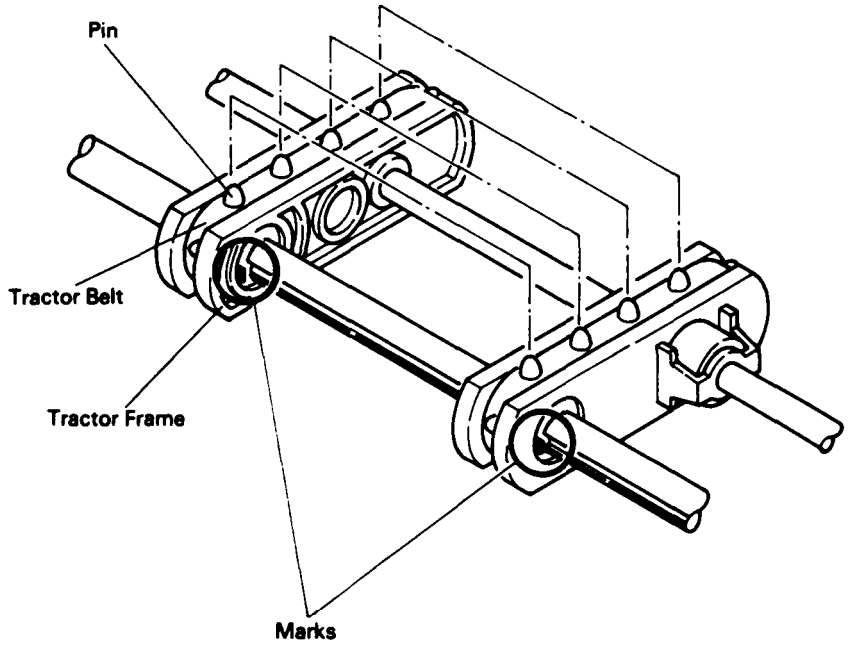


Figure 4-51. Tractor Assembly Phases

4.2.5.20 Paper Tension Unit Disassembly

This section describes the removal of the paper tension roller assembly. Since disassembled parts can be reassembled by using these procedures in reverse order, the assembly procedures have been omitted.

Step 1: Remove the RE (4) on the paper tension roller shaft at the inside of the paper tension frame R.

Step 2: Remove the RE (4) on the paper tension roller shaft at the outside of the paper tension frame L.

Step 3: Remove the CPS(O) (3 X 10) screw securing paper tension frame Lto paper tension base frame.

Step 4: Remove the HNO (4) nut.

Step 5: Disconnect the paper tension shaft holder from the paper tension frame R by sliding it toward the outside, then remove it.

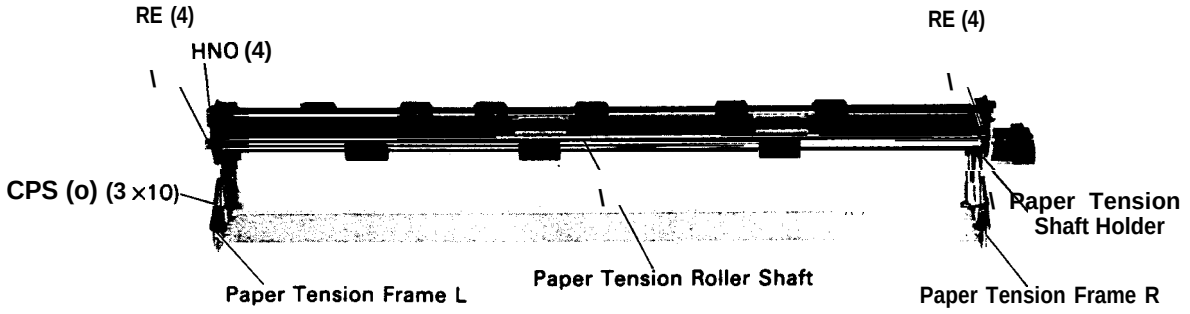


Figure 4-52. Paper Tension Roller Assembly Removal

4.3 ADJUSTMENT

This section describes the adjustment procedures required when reassembling this printer. When disassembly or replacement is performed during maintenance or repaires of the parts described in this section, the following adjustments should be performed to ensure proper operation.

4.3.1 Platen *Gap* Adjustment

Adjust the gap between the platen and the printhead when carriage guide shaft B is rotated or removed.

Step 1: Remove the printer mechanism (Refer to Section 4.2.5. l.).
Step 2: Remove the printhead (Refer to Section 4.2.5.2.).
Step 3: Remove the ribbon mask.

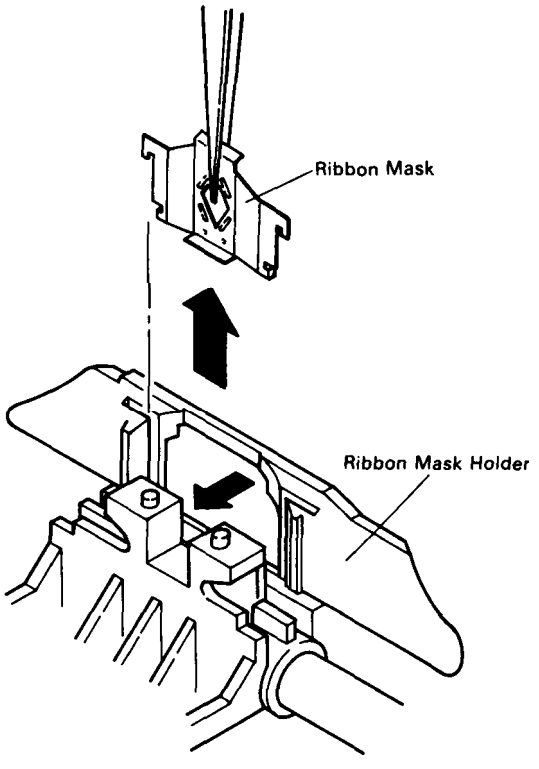


Figure 4-53. Ribbon Mask Holder and Ribbon Mask Configuration

Step 4: Reinstall the printhead on the carriage.
NOTE: When reinstalling the printhead, lock the head lock levers while pushing the printhead forward and downwoard.
Step 5: Move the carriage to center.
Step 6: Lighty loosen the HNO (4) nut securing the head adjustment lever (See Figure 4-50).
Step 7: Turn the larger countersink of carriage guide shaft B upward (See Figure 4-55).
Step 8: Insert the blade of a screw driver (a diameter is approx. 3 mm) into the countersink of carriage guide shaft B (See Figure 4-55).

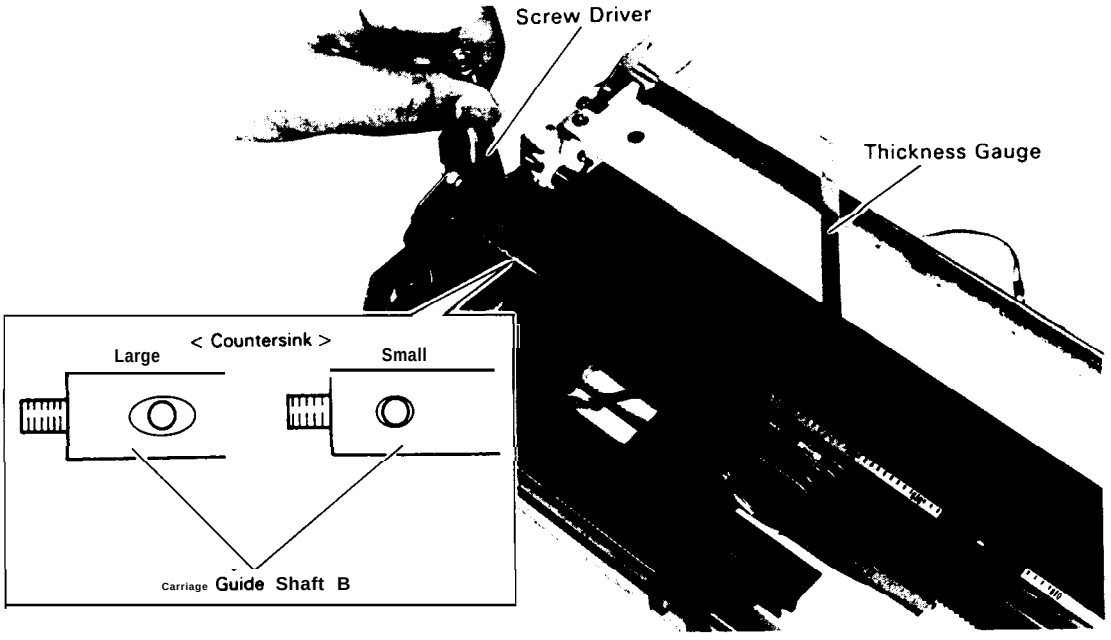


Figure 4-54. Platen Gap Adjustment

Step 9: Set the head adjustment lever at the 2nd position.

Step 10: Push the paper release lever all the way back.

Gap value: 0.51 ± 0.05 mm

Step 1 1: Adjust the platen gap using a thickness gauge while rotating carriage guide shaft B in the direction of the arrow in Figure 4-55.

WARNING

At this time, the paper release lever must be in the friction feed position. (Do not turn it forward.)

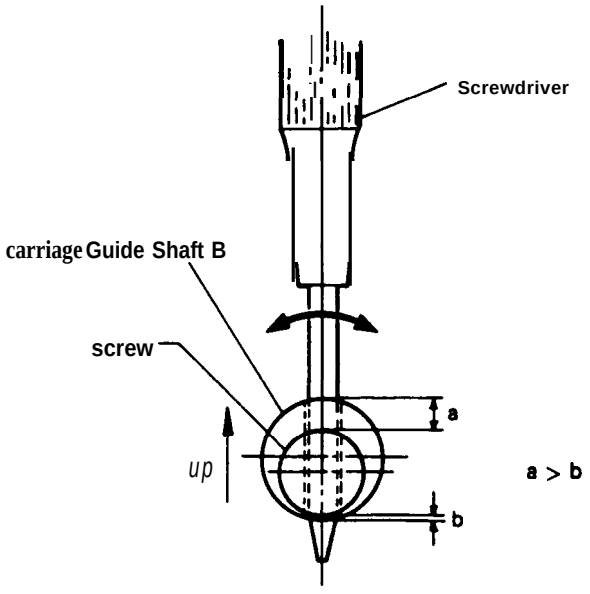


Figure 4-55. Eccentric of Carriage Guide Shaft B

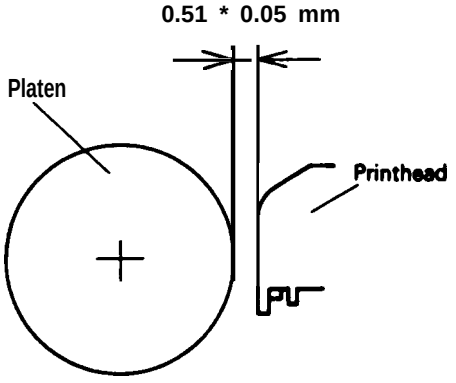


Figure 4-56. Platen Gap

Step 12: Hold carriage guide shaft B in place and tighten the HNO (4) nut.

Step 13: Move the carriage to the left end, and measure the gap value again to confirm that it is correct.

Step 14: Move the carriage to the right end, and measure the gap value again to confirm that it is correct.

Step 15: Remove the printhead.

Step 16: Reinsert the ribbon mask into the ribbon mask holder.

Step 17: Connect the FPC to the printhead, and reinstall the printhead onto the carriage.

4.3.2 Paper Feed Motor Gear Backlash Adjustment

This adjustment is required either when the paper feed motor is replaced or when its mounting position is shifted.

Step 1: Remove the printer mechanism (Refer to Section 4.2.5. 1.).

Step 2: Loosen the two CPS(O) (3 X 6) screws on the paper feed motor.

Step 3: Manually rotate the paper feed motor, and adjust the gear backlash between the pinion and the paper feed transmission gear.

Allowable backlash: 0.10 ± 0.05 mm

Step 4: Tighten the screws on the paper feed motor.

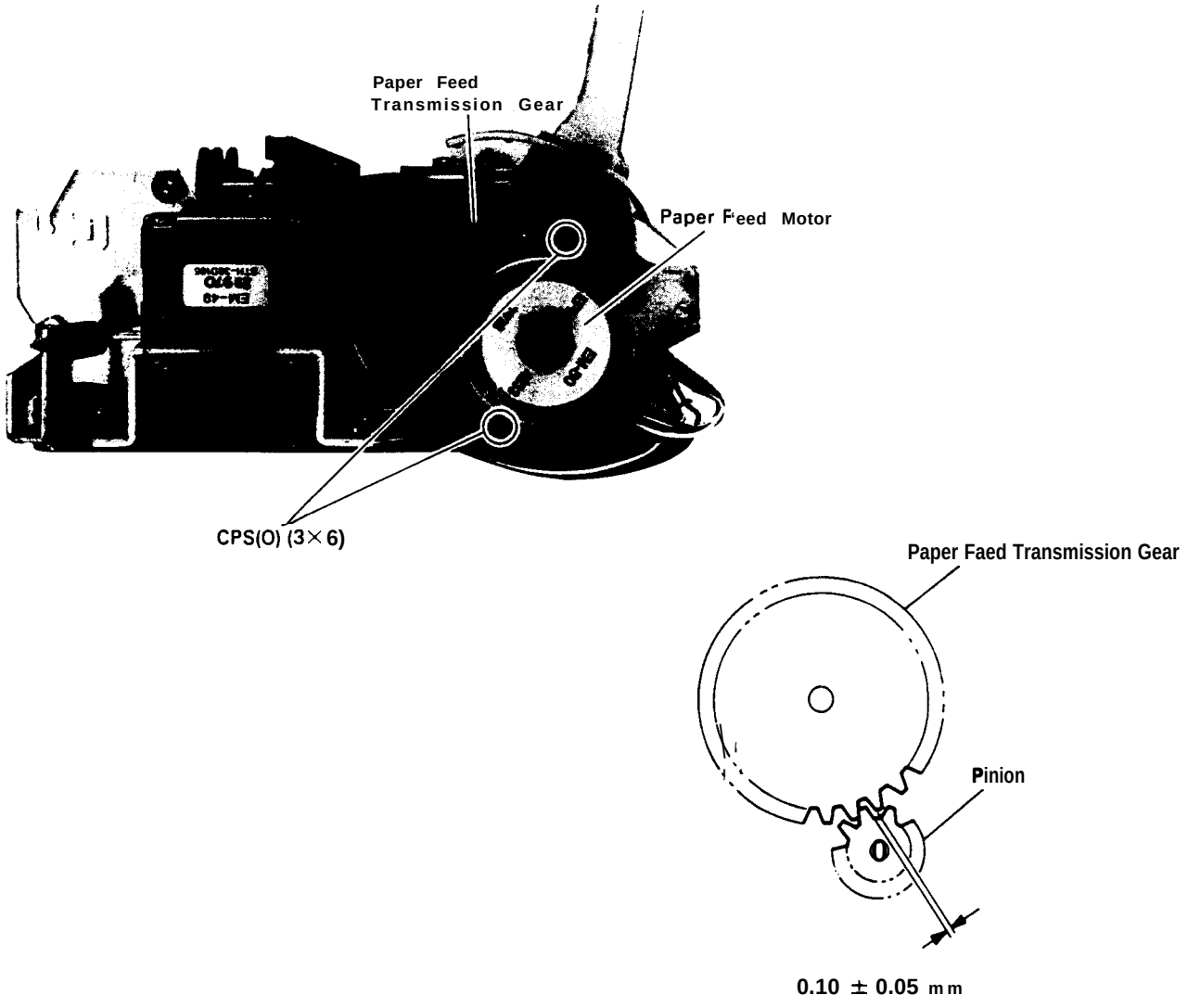
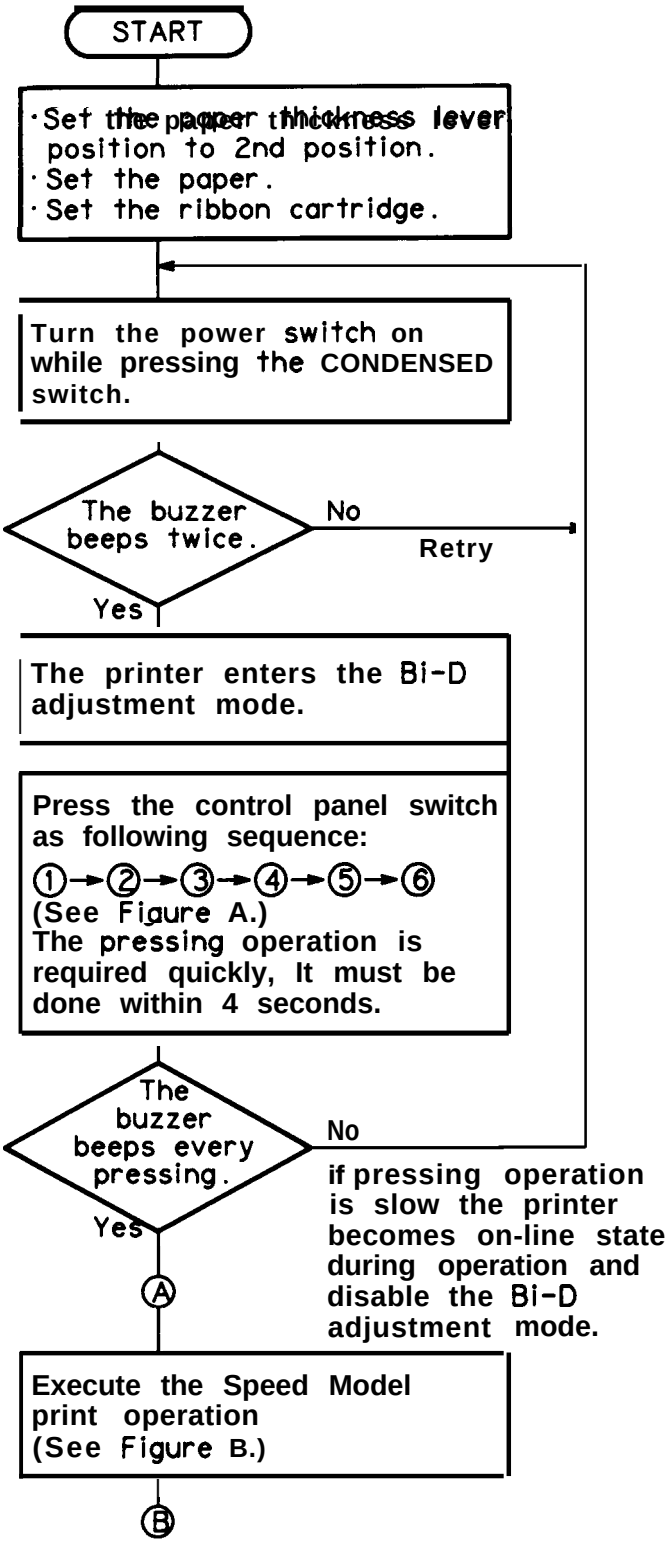


Figure 4-57. Paper Feed Motor Pinion Gear Backlash Adjustment

4.3.3 Bi-Directional Print Alignment Adjustment

If printing is misaligned in during bi-directional print operation, align the printer by control panel operation addcording to the alignment sequence flowchart shown in Figure 4-58.



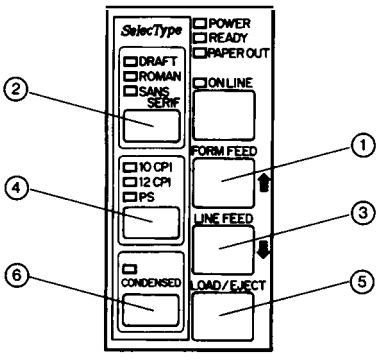


Figure A. Pressing Sequence

Figure 4-58. Bi-Directional Print Alignment Adjustment Sequence

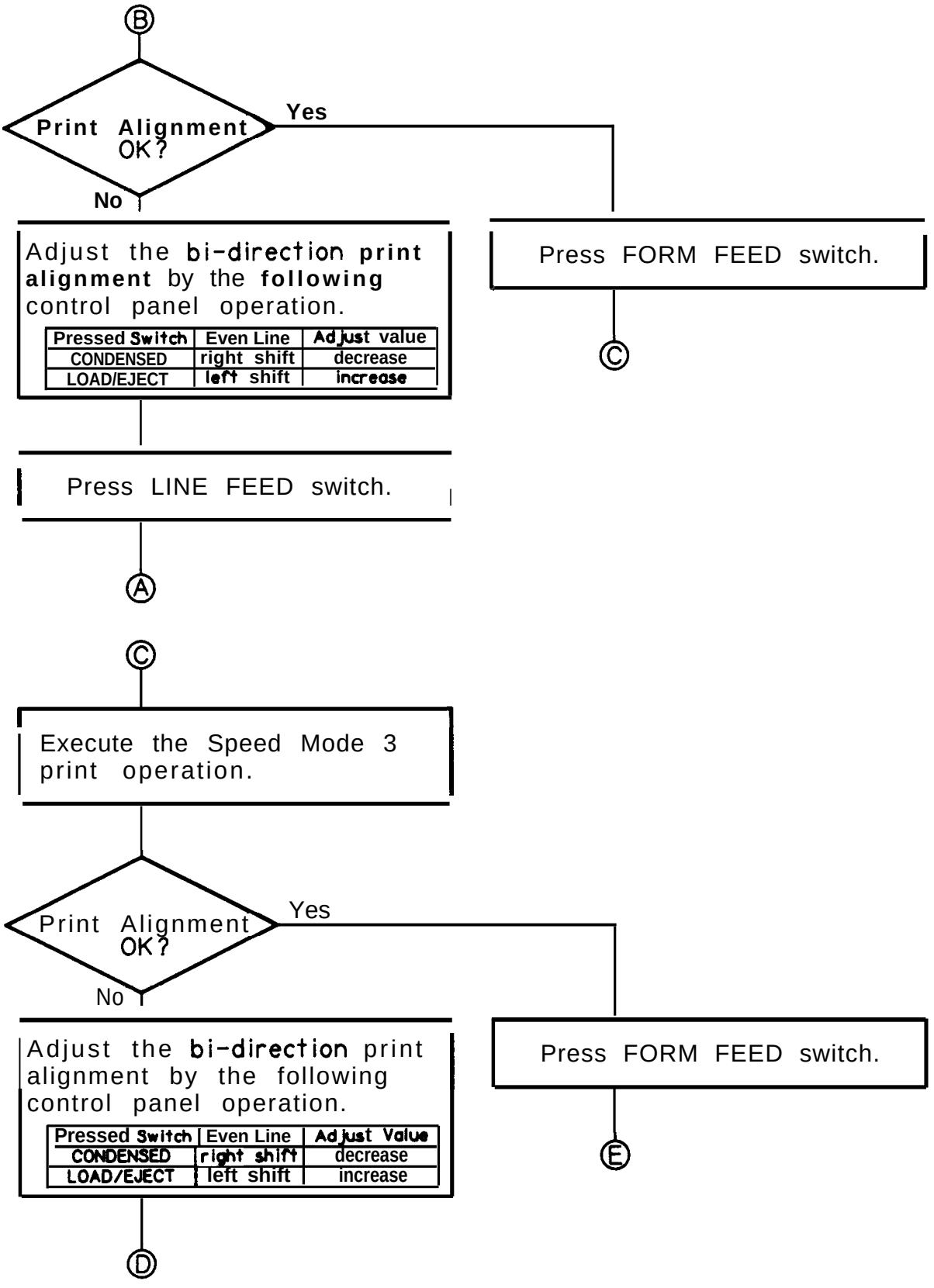


Figure 4-58. Bi-Directional Print Alignment Adjustment Sequence (cent'd)

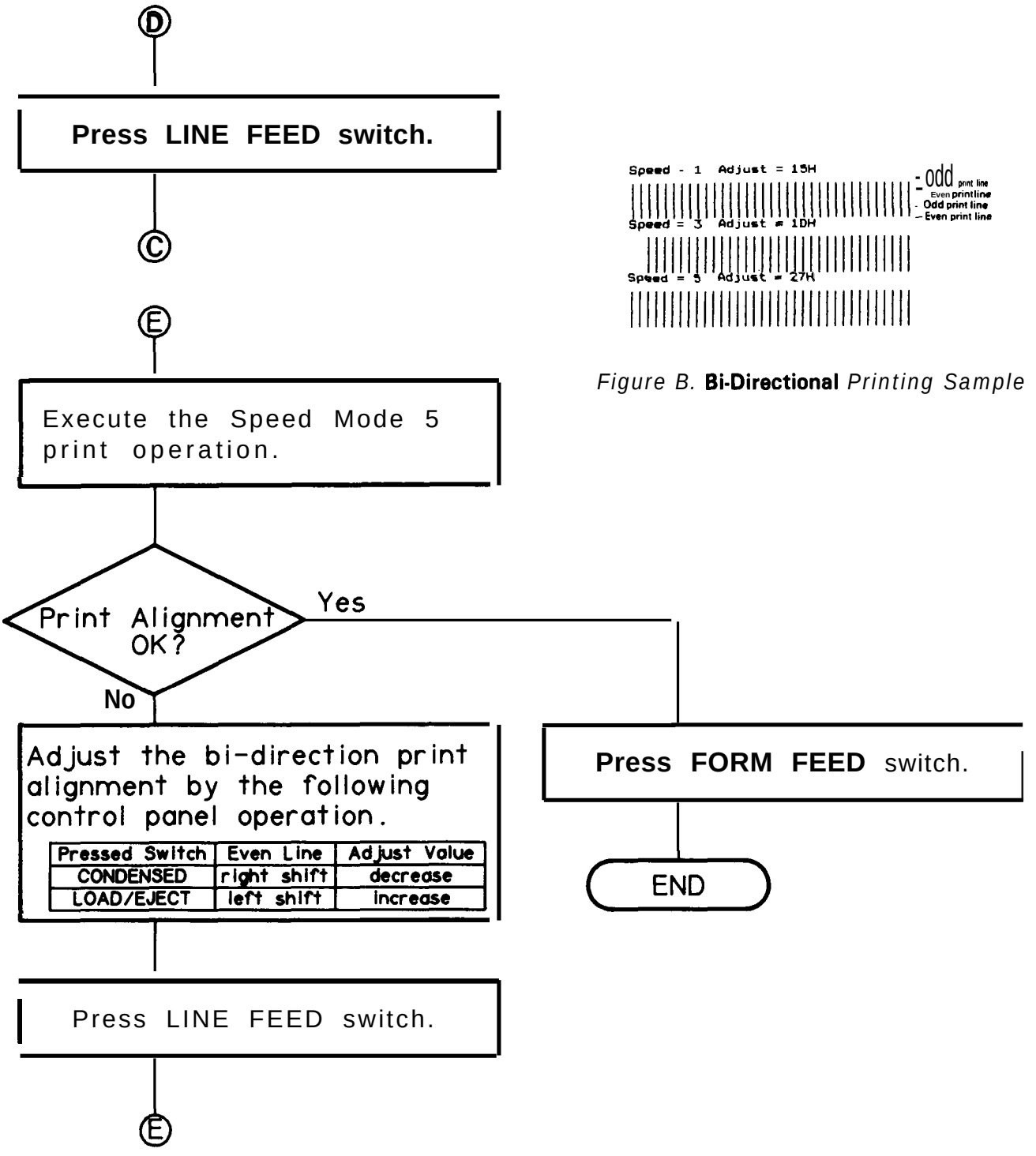


Figure B. **Bi-Directional** *Printing Sample*

Figure 4-58. **Bi-Directional** *Print Alignment Adjustment Sequence (cent'd)*

CHAPTER 5
TROUBLESHOOTING

LIST OF FIGURES

LIST FO TABLES

5.1 GENERAL

Because various types of trouble can occur, troubleshooting is not easy to perform. Here, a simple procedure is provided to perform troubleshooting, as shown in Figure 5-1.

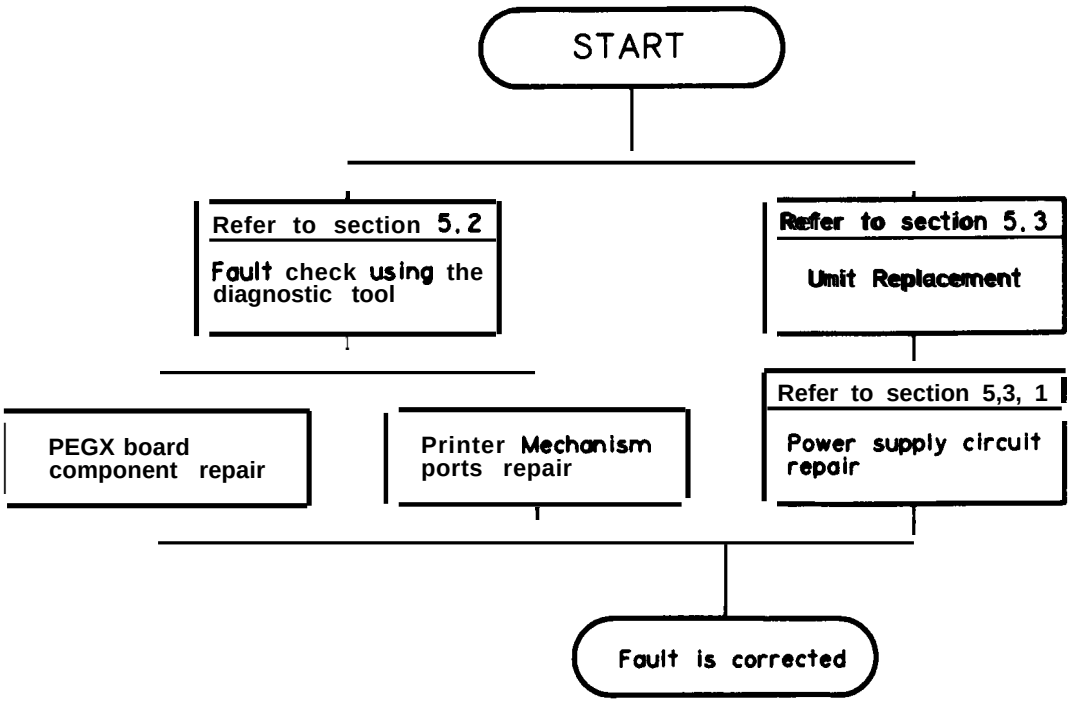


Figure 5-1. Troubleshooting Procedure

Table 5-1 lists the troubleshooting tools contained in the printer.

Table 5-1. Troubleshooting Tools

Tool No.	Item	Description	Part No.
#648	Diagnostic Tool	Use together with EPSON PC (EQUITY)\QX-16	B765 109701

5.2 DIAGNOSTIC TOOL

Due to the complex nature of printer, long experience and much effort are usually required for effective trouble-shooting. a diagnostics tool, however, provides operators with an easier and more straight-forward way of diagnosing and correcting printer problems.

5.2.1 PDOS *System Feature*

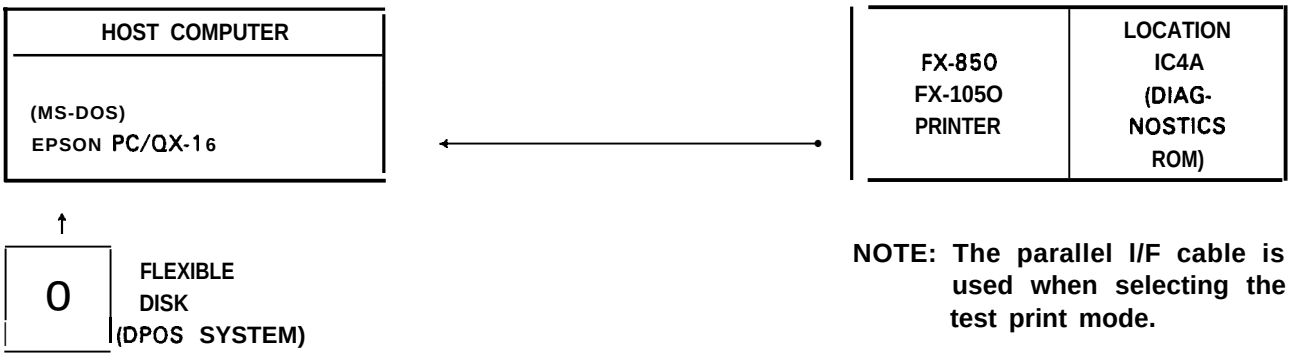
The diagnostics tool designed especially for use with EPSON printers is called PDOS (Printer Diagnostics Operation System).
PDOS can be used for maintaining, analyzing and testing all of your printer functions.
This documentation describes how to use this tools for your work.

This program can be used on any MS-DOS host computer. If it is used on another computer, the appropriate MS-DOS system and GWBASIC. EXE will be required.

The EPSON printer diagnostic tool (PDOS) has the following features:

- **Easy parts level repair.**
- **A simple structure using a host computer with MS-DOS, one flexible disk containing the programs, and a diagnostics ROM.**
  EPSON supplies only the diagnostics ROM and the flexible disk.
  B765 109701 PDOS For FX-850/1050 with IBM-PC/QX-16
- **Expertise with printer mechanisms or circuits is not required to repair a printer.**
- **No need for a circuit diagram of the printer.**
- **A wide variety of possible uses ranging from repair and analysis to testing.**

5.2.2 *System Overview*



NOTE: The parallel I/F cable is used when selecting the test print mode.

Figure 5-2. System Overview

In this system, a printer is connected to an MS-DOS-based computer using a parallel interface cable, with the diagnostics ROM installed inside the printer at location IC4A

This system works as follows:

The host computer displays the DIP switch configurations necessary for performing diagnostics on the printer.

The user sets the corresponding switch on the printer, and turns the printer power on.

The CPU in the printer reads the DIP SW, and performs the diagnostics program that depends on the DIP SW values.

5.2.3 How to Select The Host Computer

This flexible disk can be used on EPSON PC (EQUITY) or the QX-16 to select the computer.

1) Active the MS-DOS system for your host computer.
2) Remove the MS-DOS system disk.
3) Place the PDOS system disk in drive A.
4) To use PDOS on EPSON QX-16 type

   A>CC QX

   To use PDOS on EPSON PC (EQUITY) type

   A>CC IBM
5) The host computer is now selected.

NOTE: Default setting is the EPSON PC (EQUITY).

5.2.4 System Activation

After the system has been connected, as shown in Figure 5-2, turn on the Host-Computer and place the system disk in drive A.

The main program is automatically activated, and displays the initial screen message shown in Figure 5-3.

```
FX-850/1050 MAINTENANCE PROGRAM
PROGRAMMED BY EPSON, JAPAN
                VERSION 1.0 (1 987/NOV./3RD)

 NOTE: .....

                        PUSH ANY KEY TO START THIS PROGRAM
```

Figure 5-3. Initial Screen.

Next, press any key to display the manu screen.

```
DIAGNOSTICS PROGRAM FOR FX-850/1050
  1. MANUAL MODE
  2. AUTO FILE MODE
  3. AUTO MODE WITH OSCILLOSCOPE
  4. TEST PRINT MODE
  5. RETURN TO SYSTEM (MS-DOS)

PLEASE SELECT MODE (1 TO 5)=?
```

Figure 5-4. Menu Screen (Mode Screen)

5.2.5. Mode Selection

This system includes four different modes which the level of repair or the type of diagnostics to be performed. After reading the descriptions, select the mode best suited to your needs.
Each mode is described below:

(1) Manual Mode

This mode is selected by choosing No. 1 on the menu screen. It should be selected if the symptom or cause of the trouble is somewhat apparent, or if the cause of the trouble was determined using an oscilloscope or other test equipment.
Figure 5-5 shows the menu screen for the Manual Mode.

```
01: POWER. HEX    02: TEMP. HEX     03: COLUMN. HEX   04: CG.HEX
05: SW. HEX       06: SWLED.HEX     07: HOME. HEX     08: PE.HEX
.....             .....             .....

PLEASE SELECT TEST FILE NUMBER=?
```

Figure 5-5. Manual Mode Menu Screen

As shown in Figure 5-5, the menu mode displays all test file names in the system, from which a user can select the file to be executed.

If a file number is input, the description of the test file is displayed on the screen and executed. The results indicating the suspected parts are displayed.
In addition, since this mode enables the user to input a signal from the control panel, an access is provided that is not normally available. Refer to the display messages for information on the control panel operation in the diagnostics mode.
To return the main menu, press the return key.

(2) Auto File Mode

This mode is selected by choosing No. 2 on the menu screen, and is used to run all of the printer checks sequentially. All of the files shown in Figures 5-5 are executed.

This mode is useful in the following cases:

- **When the cause of the problem can not be determined.**
- **When a final check is performed.**
- **When a check is performed by the user without electronic or mechanical background.**
- **After the unit has been repaired.**

This mode can be used to find a malfunctioning part without using specific instruments such as an oscilloscope.

(3) *Auto Mode with Oscilloscope*

This mode is selected by choosing No. 3 on the menu screen, and is used to identify malfunctions in conjunction with an oscilloscope.

This mode can be used when repair is undertaken by a user who is familiar with oscilloscope operation, or when checking specific parts needing repair.

The user observes waveforms and voltages on the oscilloscope by following the instructions given on the CRT screen, and inputs the results in YES/NO format.

After the checks are finished, the suspected part is displayed on the screen.

This mode determines the malfunctioning part at its conclusion.

```
TO CHECK THE REFERENCE VOLTAGE OF A/D CONVERTER:
IS THE VOLTAGE LEVEL OF IC7B (CPU) PIN42 ABOUT + 5V?
[NON SYNC: 2V/DIV. OR N(0) ESC/DEL/F1 KEY ]
```

Figure 5-6. **Question** *Screen (Example)*

The 2nd line is the question.

The 3rd line describes the range of oscilloscope.

NON SYNC: Internal Trigger Mode

SYNC: External Trigger Mode

If the answer is “Yes” then press “Y”.

If the answer is “No” then press “N”.

To leave this part of the test press the ‘ESC KEY’

To return to a previous part of the test press the ‘BS or DEL KEY’.

To return to the main menu, press the ‘F1 key’ and ‘Enter key’

(4) Test Print Mode

This mode is selected by choosing No.4 on the menu screen. This mode is useful for testing printer functions.

Unlike the built-in printing test, this mode can perform various test operations. The main functions are as follows:

. Checks the circuits including the parallel and serial interface circuits (Selectable Interface).
- **Checks the Bi-Directional printing position lag during actual printing.**
- **Checks the paper feed unit backlash.**
- **Checks the printed wires (Pins).**
- **Prints a bit image to check for irregular printing or paper feeding.**
- **Down loads special character to check dot alignment.**
- **Checks the height lag during double height printing.**

After repairing the printer, this mode should be used to test the unit.
You can select the printer types, interface types, and mode of test print.

=Function Check (Final Check)

This mode is used to check ail of the printer function.
Bi-Directional printing alignment check.
Bit Image Mode.
Down Load Printing.
Wire (Pin) Check.
Etc.

=Mode Check ("H" Character)

This mode is used to check all of the printing modes.
Bi-Directional printing alignment check.
Etc.

=CG Table check

This mode is used to check all of the characters in the CG ROM.
Draft mode (10, 12, 15 Pitch)
Roman Mode (10, 12, 15, PS·Pitch)
Saris-Serif Mode (10, 12, 15, PS Pitch)

5.2.6 *PDOS for RAM and CPU Check*

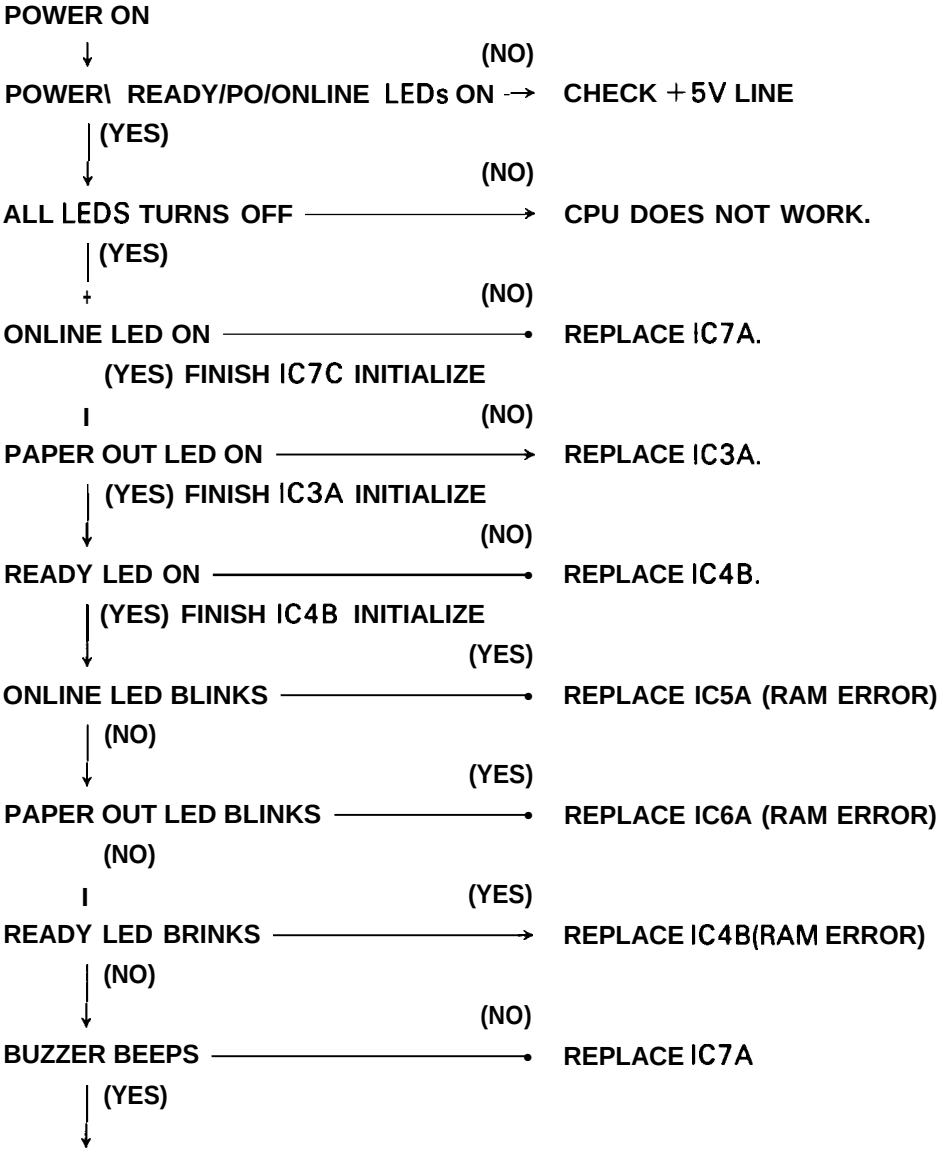
If you want to run only the RAM check or CPU check, you do not need the host computer. Install the diagnostics ROM in the printer at location IC4A.

FX-850/1050 PRINTER	LOCATION IC4A DIAGNOSTICS ROM

NOTE: Check does not require connection to a host computer.

Figure 5-7. RAM and CPU Check

(1) Turn the power on.
(2) Check to see if the ONLINE LED light is on or off.
(3) Check to see if any LEDs are blinking.



If you want to test the printer without a host computer, then set dip SW1 as follow:

Table 5-2. Off-Line Diagnostics

DIP SW1	FUNCTION
OOH	RAM Check & CPU check
OIH	Address/Data line Hi/Lo
02H	Home position sensor check
03H	Paper end sensor check
04H	F/T sensor check (F/T: Friction/Tractor)
05H	Control panel SW check
06H	Head drive Transistors short circuit check
07H	Head drive voltage (+ 24) check
08H	Motor drive voltage (Vu) check
09H	Paper feed motor phases output
OAH	Carriage motor phases output
OBH	Plunger solenoid On/Off
OCH	Plunger drive voltage change drive/hold
ODH	Paper feed motor drive voltage change drive/hold
OEH	Plunger enable line change disable/enable
OFH	Interface control line Hi/Lo
10H	Carriage motor current change line Hi/Lo
11H	All selecType LED On/OFF

5.2.7 *Programmer Tips*

(1) If you are lost in the program, press function key no. 1 IFl] and then the enter key to re-start program.

(2) If you want to skip any file (or program), then press the ESC key.

If you want to return to a previous file (or program), then press DEL key.

5.3 UNIT REPLACEMENT

This replacement is based on system analysis. According to the particular symptom found by the multimeter, the units listed in Table 5-3 need to be replaced.

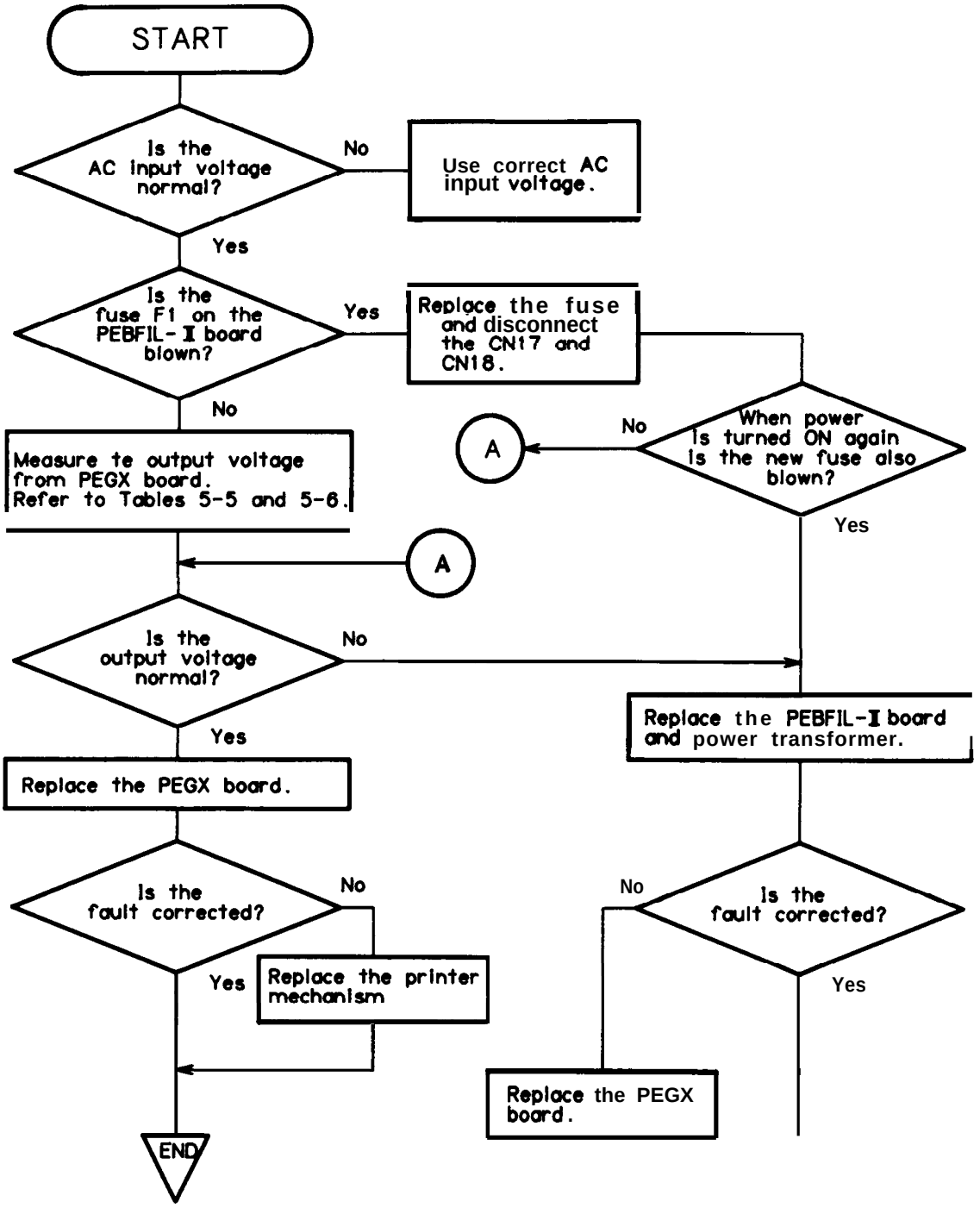
Table 5-3. Unit Parts List

Name	*Description*	*Part No.*
Fuse (FI)	120V: 125V, 2A 220/240V:250V, 1.25A	X50206 1011 X502063040
PEGX Boards	Main Circuit Board	Y46 1201000
PEBFIL-II Board	120V Filter Board 220/240V Filter Board	Y566204200 Y566204000
Power Transformer	10OV (FX-850) 120V (FX-850) 220V (FX-850) 240V (FX-850)	Y566503000 Y566504000 Y566505000 Y566506000
	100V (FX-1 050) 120V (FX-1 050) 220V (FX-1 050) 240V (FX-1050)	Y46 1502000 Y46 1503000 Y46 1504000 Y46 1505000
Model-3B 10 Model-3B60	Printer Mechanism (FX-850) Printer Mechanism (FX-1050)	Y46 1590100 Y462590100
PGPNL Board	Control Panel	Y46 1501000

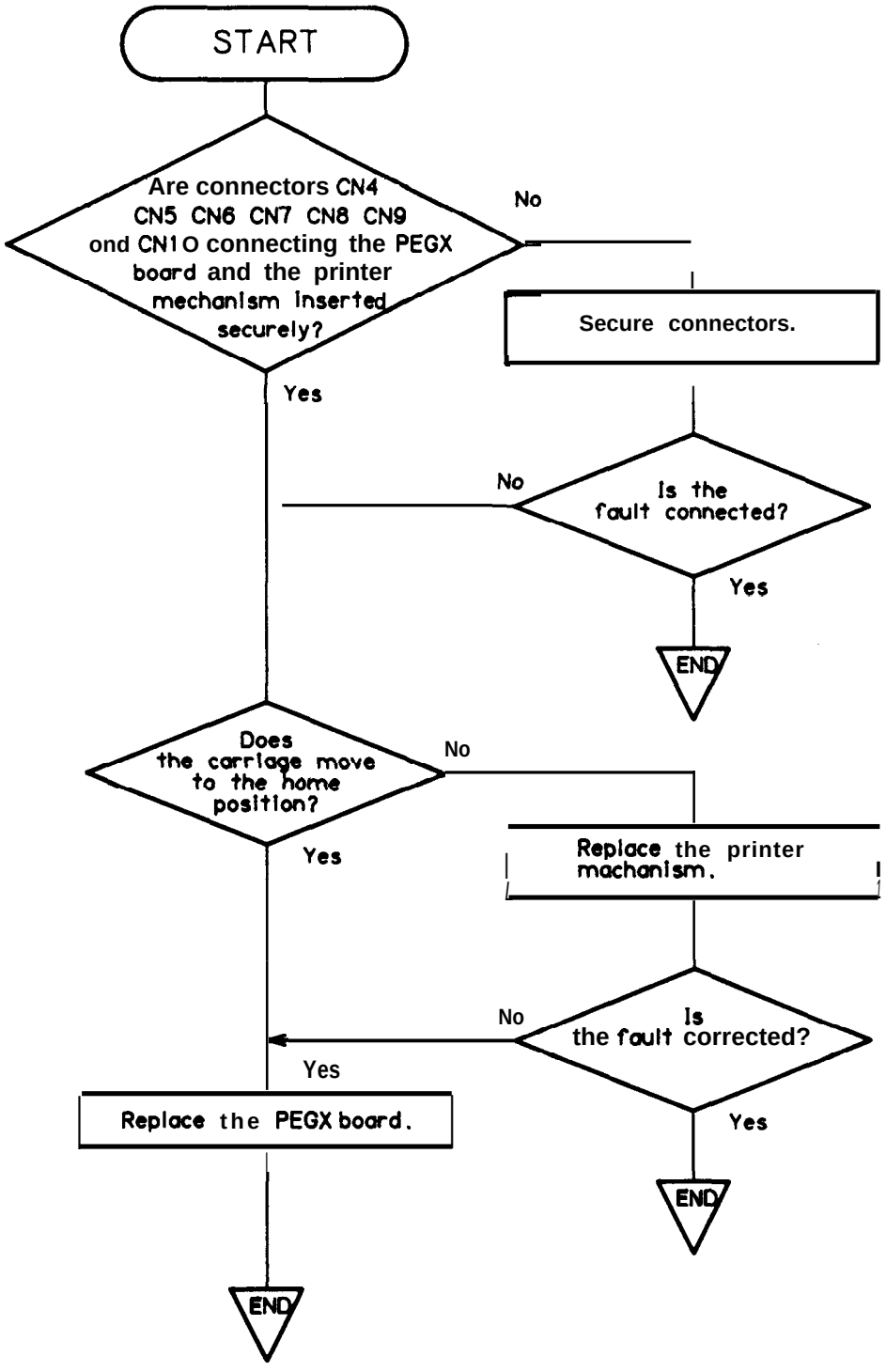
Table 5-4. Symptom and Reference Pages

Symptom	Problem Indicators	Reference Page
Printer Does Not Operate with Power Switch ON	. No indicator on the control panel lights. ● Carriage does not move.	5-11
Abnormal Carriage Operation	. Carriage moves away from home position at power ON. . Although the carriage returns to the home position, the printer does not enter READY mode.	5-12
Incorrect Printing (in self-test) with Normal Carriage Operation	● No printing is executed. ● Printhead dot missing.	5-13
Abnormal Paper Feed	● No paper is fed. ● Separation between lines varies with irregular paper feed.	5-14
Abnormal Operation of Control Panel	● No paper is fed (by operation of the LF or FF switch) in OFF-LINE mode. ● No operation mode is set from the control panel. . ON-LINE or OFF-LINE mode is not obtained.	5-15
Incorrect Printing in ON-LINE Mode	● Carriage operates normally at power ON and the result of the self-test is correct. However, the print data from the computer is not output normally.	5-16

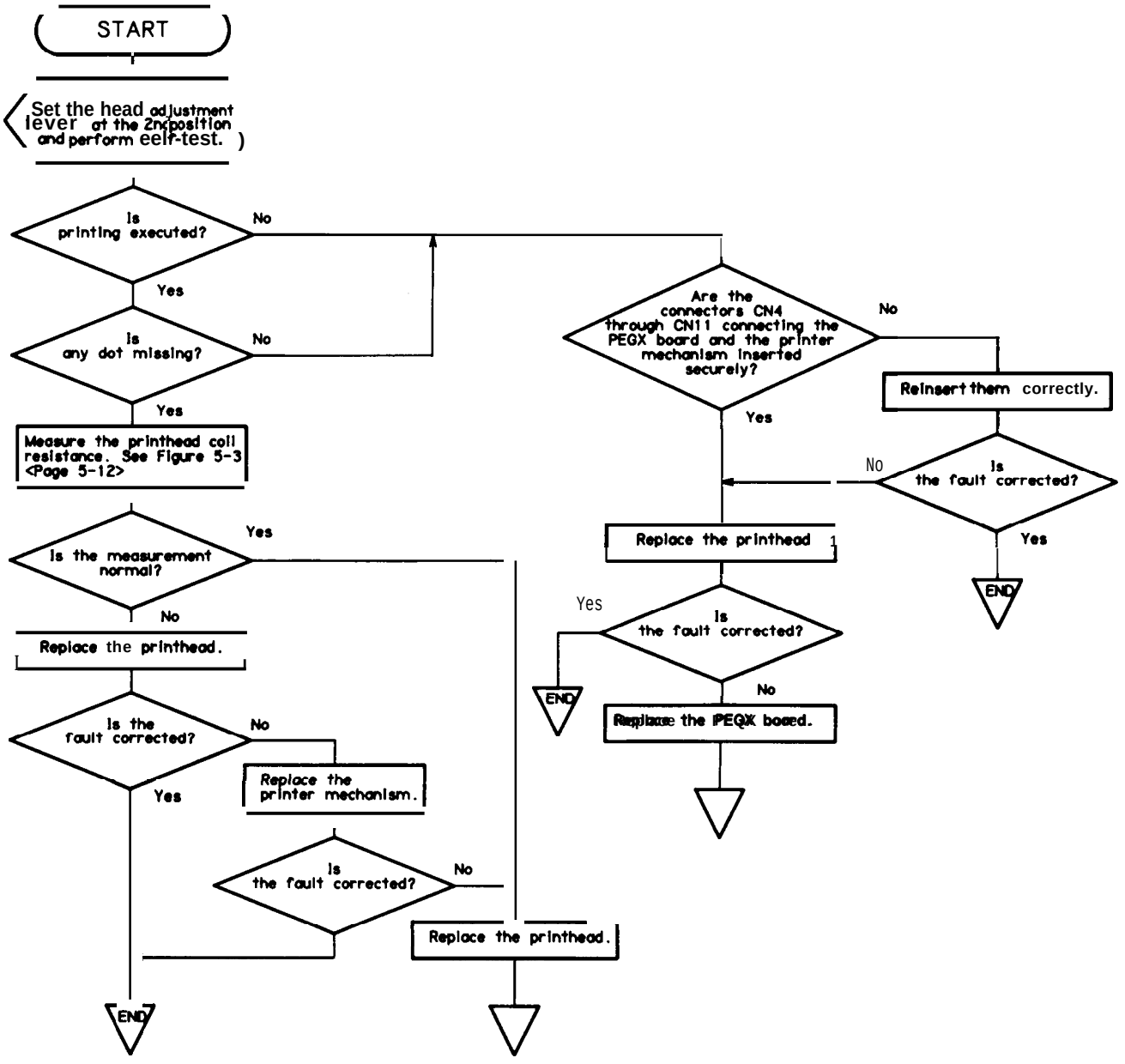
1. Printer does not operate with power switch ON (POWER LED does not light.)



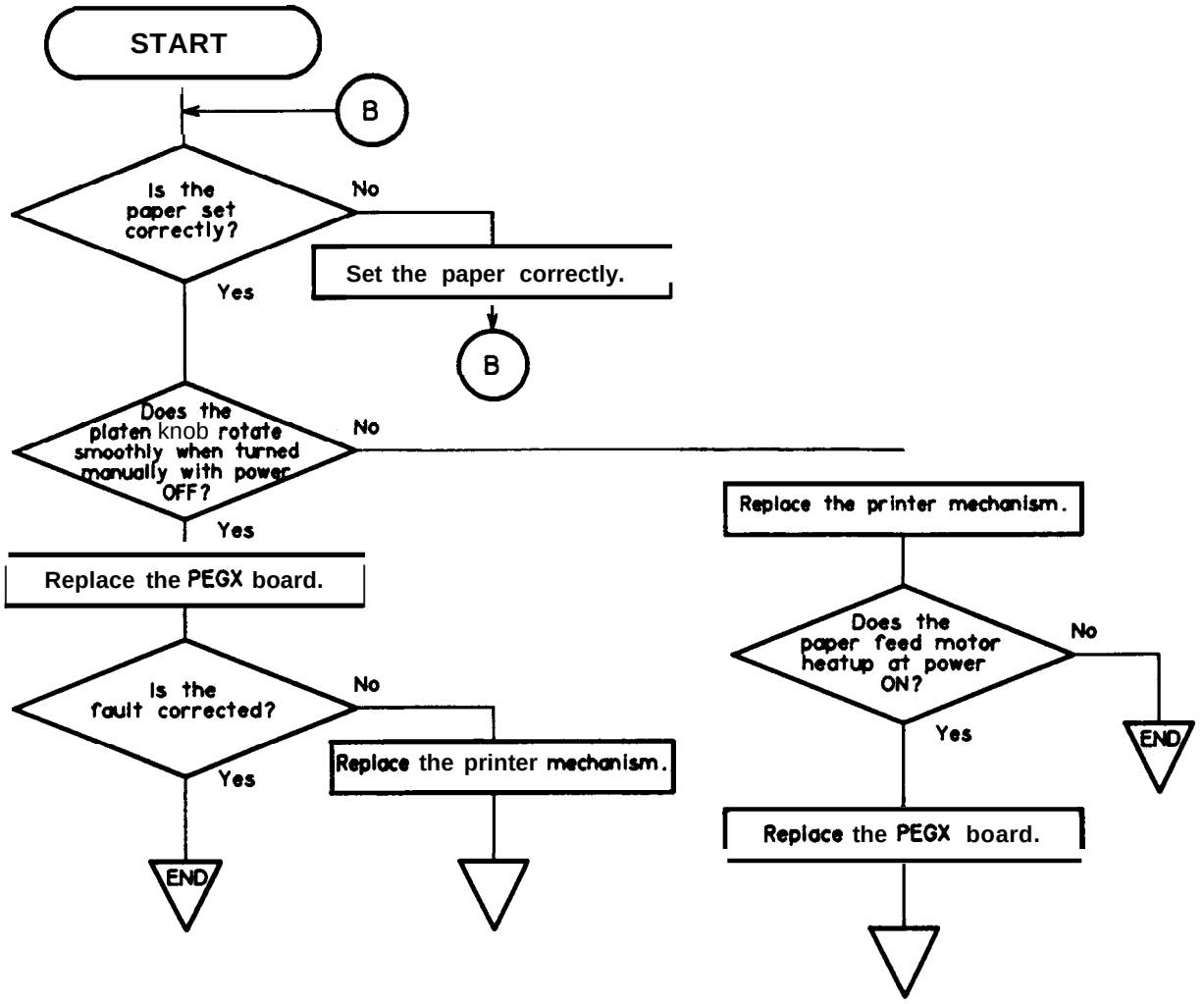
2. The carriage does not operate correctly.



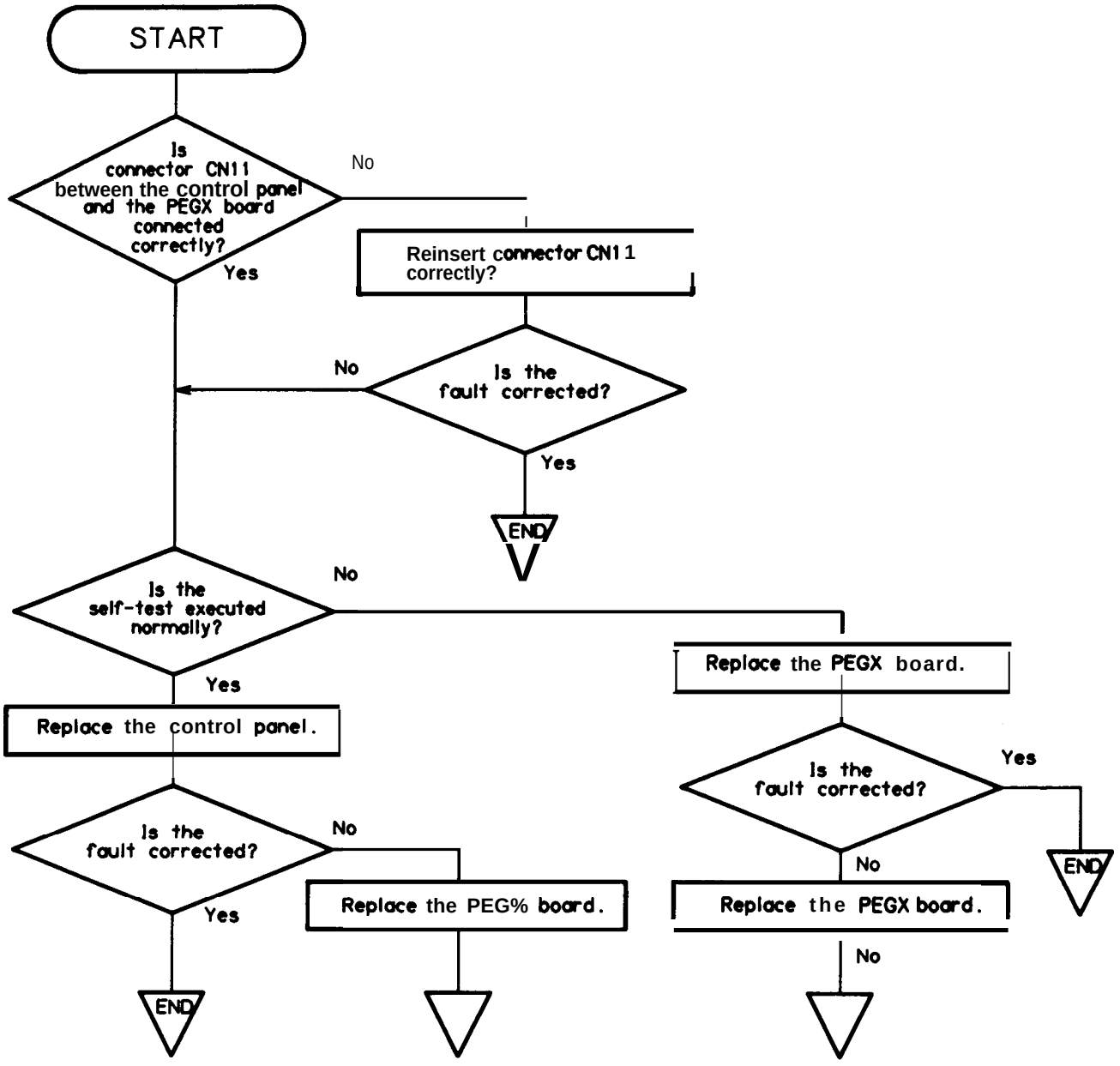
3. The carriage operates normally, but the self-test printing is incorrect.



4. The self-test printing is normal, but the paper is not fed properly.

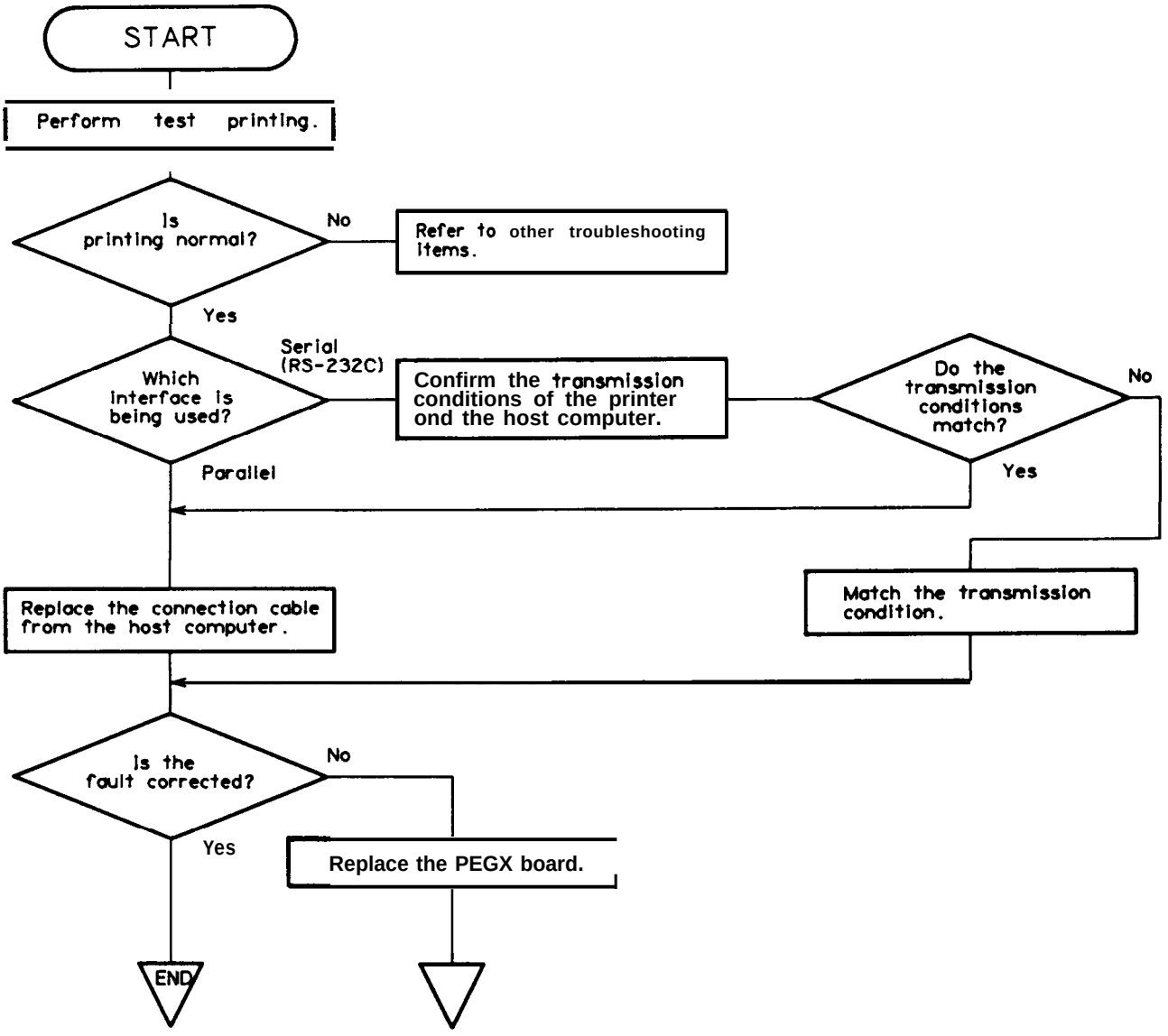


5. The control panel does not operate correctly.



6. The printing is incorrect in the ON-LINE mode.

NOTE: It is assumed that the host computer operates normally.



5.4 UNIT REPAIR

Unit repair is comprised of three parts: (1) repair of the power supply circuit; (2) repair of the control circuit; (3) repair of the printer mechanism.

This section describes (1) power supply circuit unit repair. If (2) control circuit, or (3) printer mechanism need repair, use the diagnostic tool introduced in Section 5.2.

5.4.1 Power Supply Circuit

This section indicates possible causes and checkpoints for different of power supply circuit. The checkpoints include waveforms for normal operation. By referring to the checkpoints, determine the detective component and perform the proper repair. Table 5-6 has the following four columns:

- **Symptom: Check symptoms against those given in this column.**
- **Cause: Check problems against the causes listed in this column.**
- **Check Point: Use the instructions given in this column for troubleshooting.**
- **Solution: Make repairs according to the instructions given in this column.**

Table 5-5. Power Supply Circuit Parts List

Location	*Name*	*Description*
IC 1A	NJM2355	Pulse width modulation control
DB1	DBF608	Diode Bridge 100V, 6A
Qlo, Q12	2SA1 450	80V, 500mA, 600mW
Q11	2SC3748	60V, 10A
Q13	2SC3746	60V, 5A
F2	—	Fuse 250V, 3 15A
F3	—	Fuse 125V, 2A
F4	—	Fuse 125V, 2A

Table 5-6. Power Supply Circuit Unit Repair

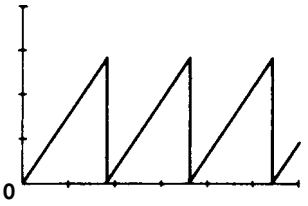
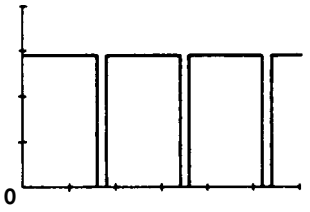
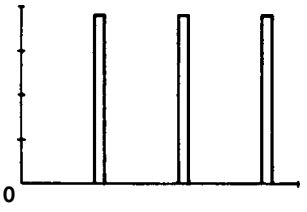
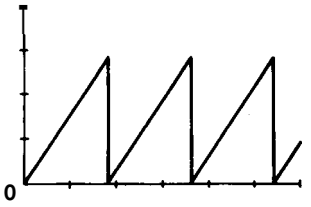
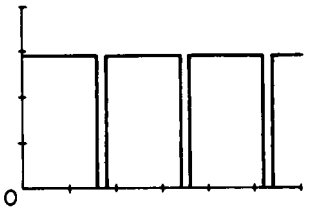
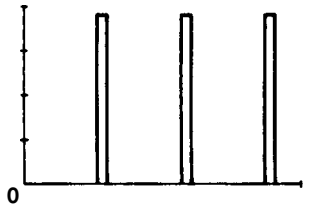
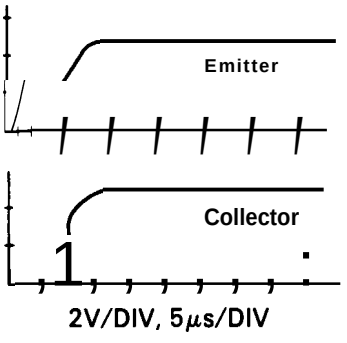
Symptom	Cause	Check Point	Solution
The +5V dead.	IC 1A is defective.	Observe the oscillation waveform and the switching waveform.  1V/DIV, 20μs/DIV Oscillation Waveform (pin 2 of IC 1A)  10V/DIV, 20μs/DIV Switching Waveform (Pin 9 of IC 1A)	Replace IC 1A
	Transistors Q 12 and Q 13 are defective.	Observe the chopping waveform  10V/DIV, 20μs/DIV Chopping Waveform (Emitter of Q13)	Replace Q12 or Q13.

Table 5-6. Power Supply Circuit Unit Repair (cent'd)

Symptom	Cause	Check Point	Solution
The +24V dead.	IC 1A is defective.	Observe the oscillation waveform and the switching waveform.  1V/DIV, 20μs/DIV Oscillation Waveform (Pin 2 of IC 1A)  10V/DIV, 20μs/DIV Switching Waveform (Pin 1.1 of IC 1A)	Replace IC 1A
	Transistors Q10 and Q11 are defective.	Observe the chopping wave form  10V/DIV, 20μs/DIV Chopping Waveform (Emitter of Q1O)	Replace Q10 or Q11
Vx voltage is not output.	Q23, Q30, and ZD 10 defective.	Observe the Vx voltage, when printer power is turned on.  2V/DIV, 5μs/DIV Vx Voltage Waveform (Q23)	Replace Q23, Q30 or ZD1 O.

5.3.2 Control Circuit

The control circuit can be repaired using the diagnostic tool to identify the problem. Table 5-7 lists the main parts of the control circuit.

Table 5-7. Control Circuit Parts List

Location	Name	Description
4B	μPD78 10HG	Main CPU 15 MHz
3A	E05A15HA	Gate Array
7A	E05A16GA	Gate Array
5A, 6A	HM6264ALSP	Static RAM 64K bit
2A	STK6722H	Hybrid IC, Carriage Controller
4A	27256	32K Byte P-ROM
Q1-Q9, Q16	2SC3987	60V ± 10V, 3A, 2W
Q15	2SB76SK	120V, 3A, 1.5W
Q17	2SB1318	100V, 3A, 1.2W
Q 18-Q21	2SD560(4)	120V, 5A, 1.5W
Q22, Q25, Q30	2SC1815	60V, 150mA, 400mW
Q23, Q24	2SA1015	50V, 150mA, 400mW

5.4.3 Model-3 B10/3B60 Printer Mechanism

Use the diagnostic tool to detect malfunctions among the carriage motor, paper-feed motor, and sensor, Table 5-8 lists the specifications for these components, use the printing test, and also inspect visually.

Table 5-8. Electric **Device List**

Name	Description		
Carriage Motor	Type		4-phase, 200 pole stepper motor
	Voltage	:	Driving +36VDC, Holding . . . +5VDC
	Coil Resistance	:	11 Ω ± 7% (25 °C/phase)
	Excitation	:	1-2 phase, 2-2 phase
Paper Feed Motor	Type		4-phase, 48 pole stepper motor
	Voltage	:	Driving +36VDC, Holding . . . +5VDC
	Coil Resistance	:	78 Ω ±7Ω (25 °C/phase)
	Excitation	:	2-2 phase
Plunger	Type		Solenoid
	Voltage	:	Driving . . . +36VDC, Holding . . . +5VDC
			No operation . . . OV
	Coil Resistance	:	22 Ω ±5% (20°C)

CHAPTER 6
MAINTENANCE

LIST OF FIGURES

LIST OF TABLES

6.1 PREVENTIVE MAINTENANCE

Proper maintenance is essential to maintain optimal printer performance for the longest possible period and to minimize malfunction frequency. Preventive maintenance includes regular cleaning of the case exterior, using alcohol, and occasional vacuuming of the mechanism interior to remove dust and paper particles. Following cleaning, refer to Section 6.2 to verify that the unit is adequately lubricated. Before returning the serviced printer to the consumer, inspect the springs, paper feed rollers, and the basic operation of the unit.

WARNING

Disconnect the printer from the power supply before performing maintenance. Do not use thinner, trichloroethylene, or ketone-based solvents on the plastic components of the printer.

6.2 LUBRICATION AND ADHESIVE APPLICATION

EPSON recommends that the points illustrated in Figure 6-2 be lubricated according to the schedule listed in Table 6-2, with EPSON O-2 and G-27, which have been extensively tested and found to comply with the need of this printer (Refer to Table 6-1 for details of O-2 and G-27.). Be sure that the parts to be lubricated are clean before applying lubricant, and avoid excessive application, which may damage related parts.

Adhesive application is necessary at the point indicated in Table 6-3 when the part is disassembled or replaced EPSON recommends Neji lock #2 (G) adhesive be applied to the point diagrammed in Figure 6-5. Avoid overview of excess to related parts.

Table 6-1. Lubricants and Adhesive

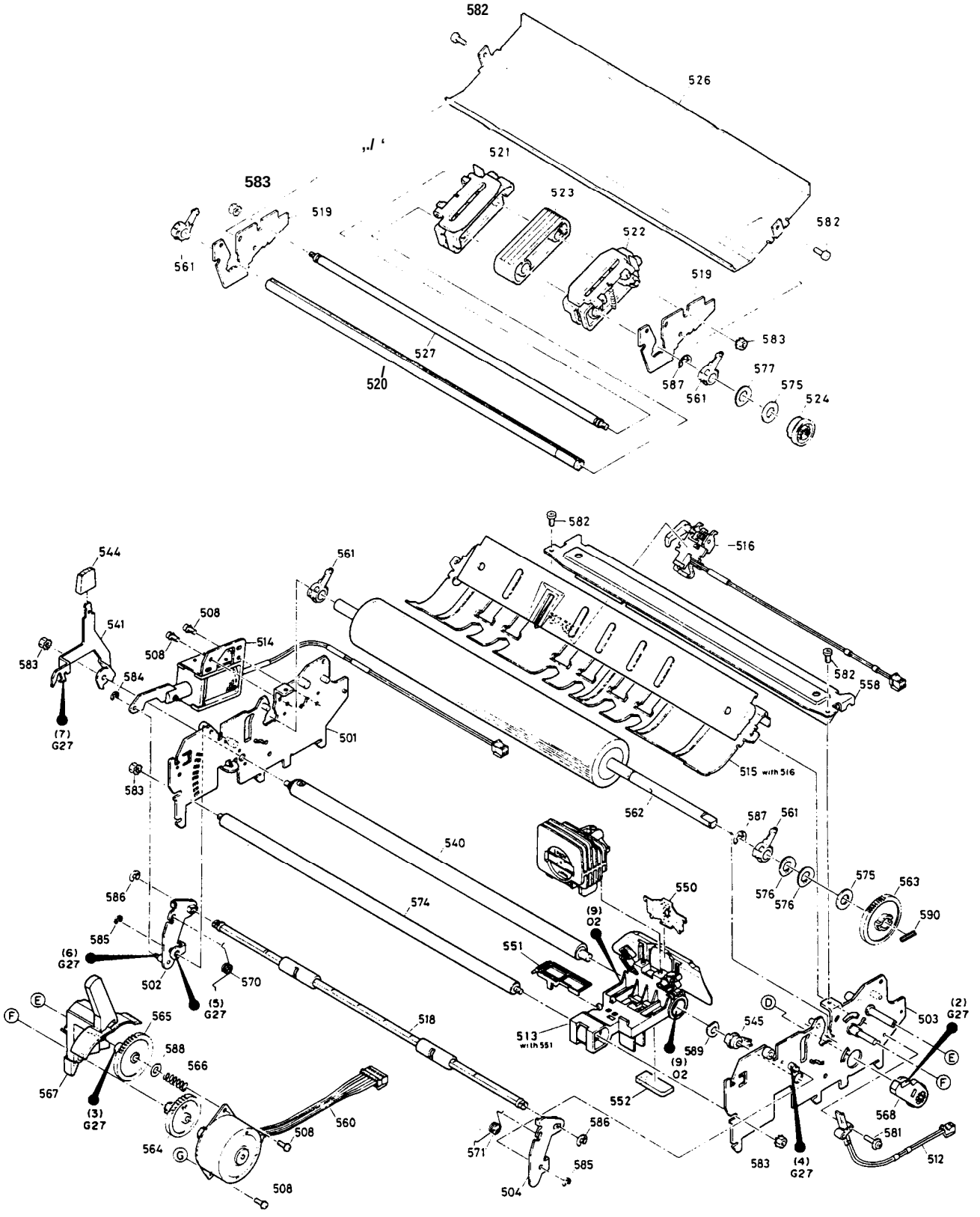
Classification	Designation	Capacity	Availability	Part No.
Oil	o-2	40 cc	E	B7 10200001
Grease	G-27	40 gr	E	6702700001
Adhesive	Neji lock #2 (g)	1000 gr	E	B730200200

E: EPSON exclusive product

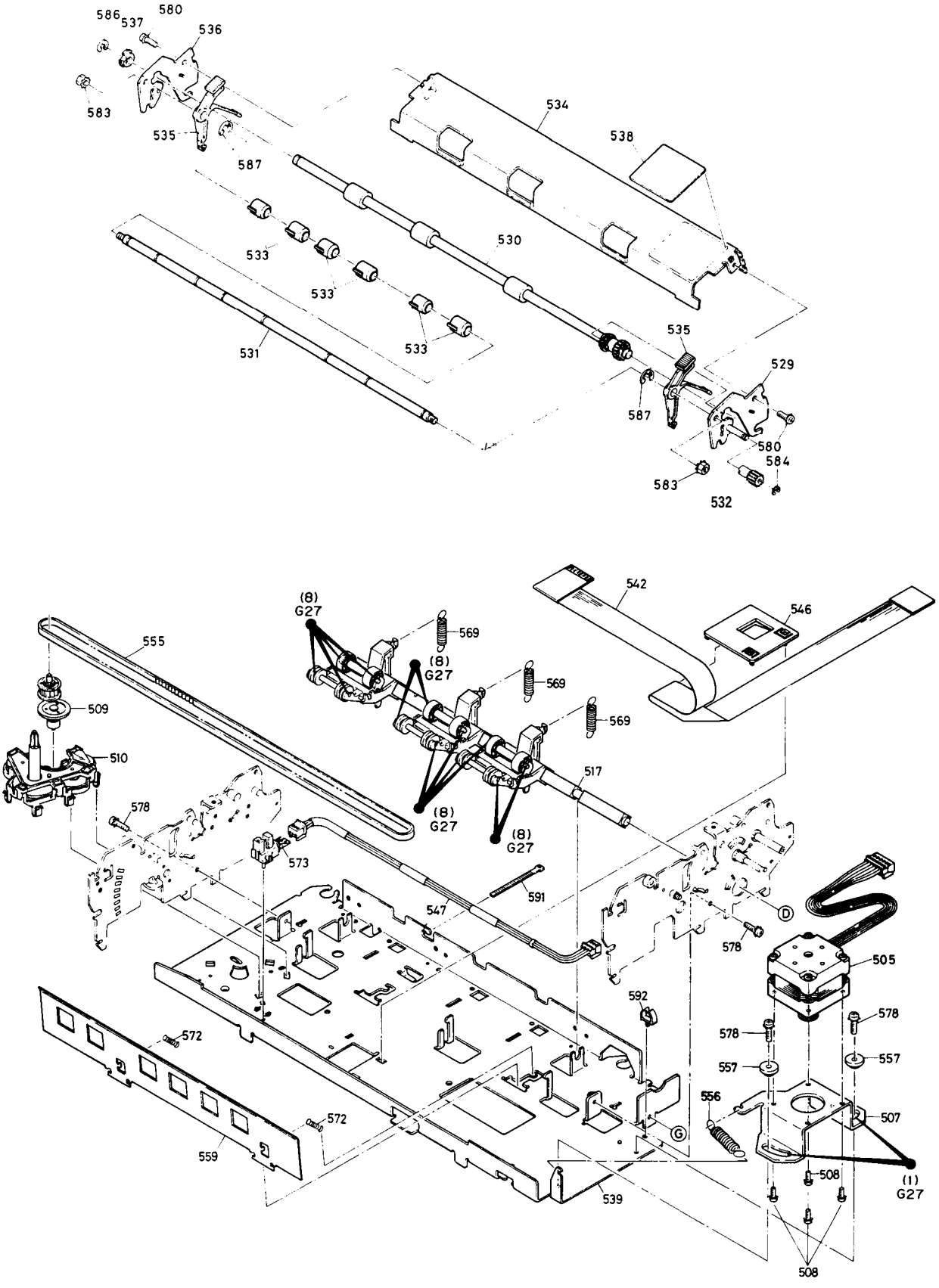
Table 6-2. Lubrication Points (Refer to Figures 6-1 through 6-4.)

Ref. No.	Lubrication Point	Lubricant
(1)*	Contact portion of carriage motor mounting plate and base frame	G27
(2)*	Contact portion of sub paper release lever and paper release lever	G27
(3)*	Contact portion of tractor transmission gear and paper release lever	G27
(4)"	Contact portion of paper holding lever R and shaft	G27
(5)*	Contact portion of paper holding lever L and shaft	G27
(6)*	Contact portion of loading lever and shaft	G27
(7)*	Contact portion of head adjustment lever tab and holes of side frame L	G27
(8)*	Contact portion of paper feed roller holder and paper feed roller	G-27
(9)*	Carriage felt	02

*: Lubrication is necessary in the process of assembly.



Fogire 6-1. FX-850 Lubrication Points Diagram (1)



Fogire 6=2. FX-850 Lubrication Points Diagram (2)

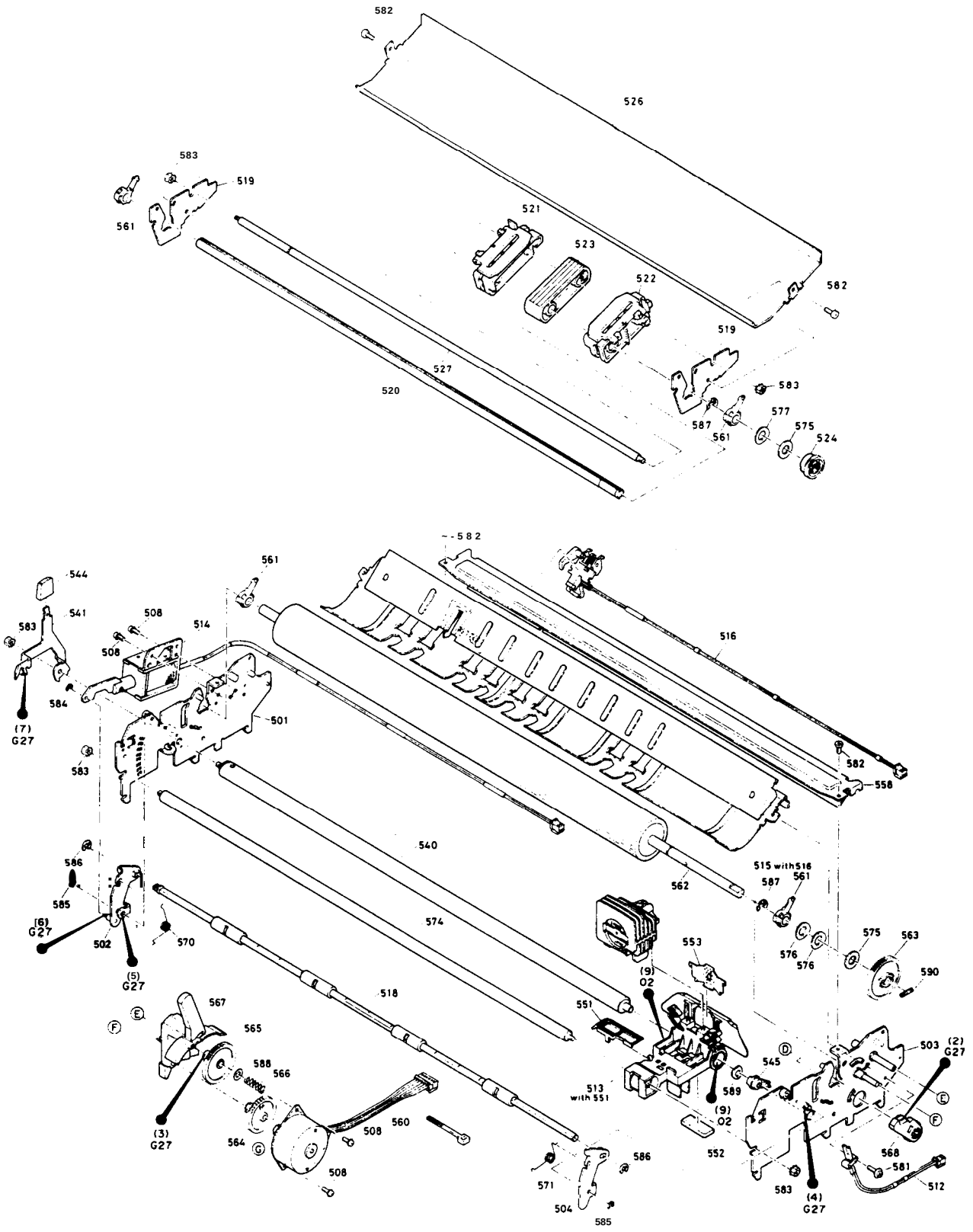


Figure 6-3. FX-105O Lubrication Points Diagram (1)

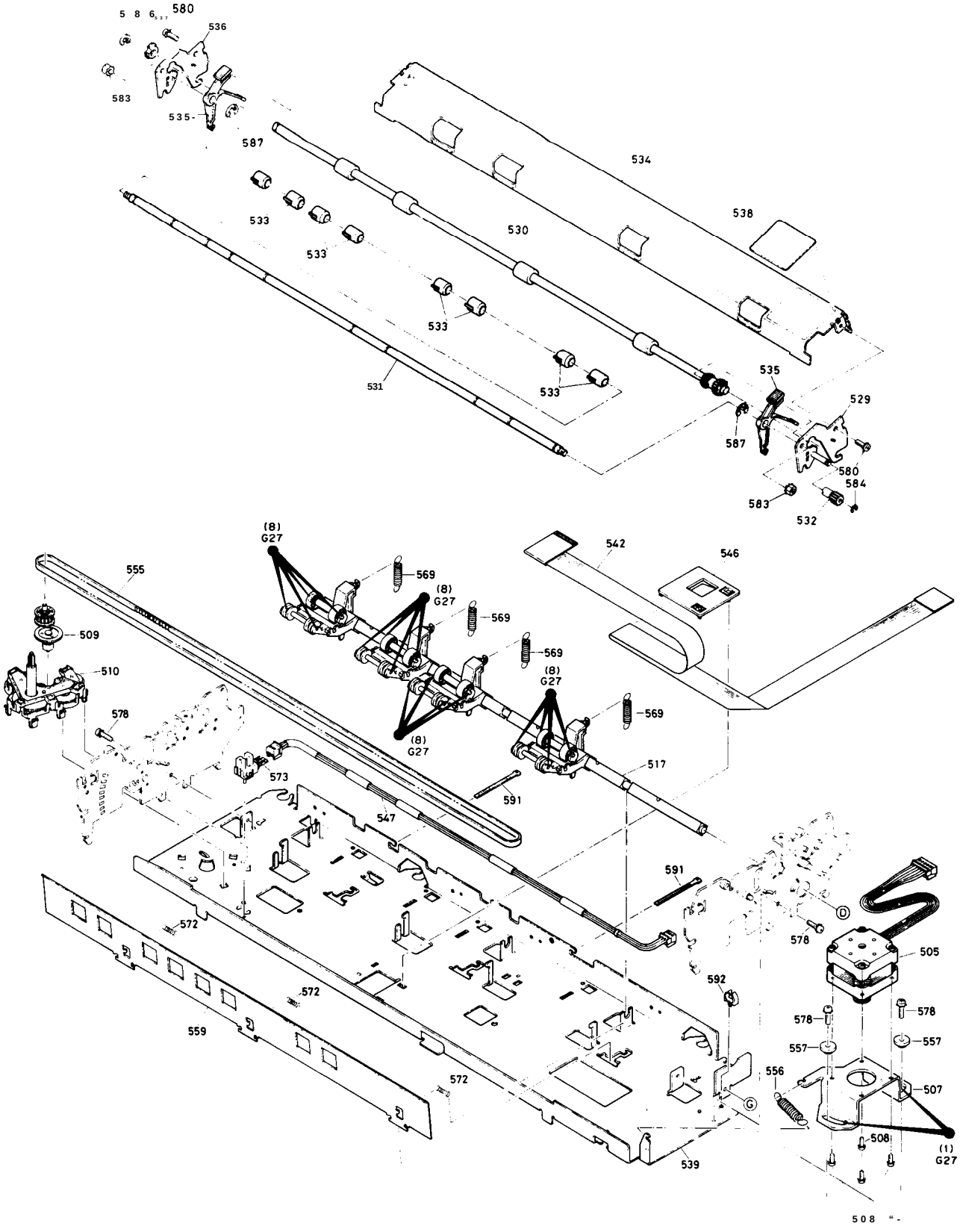
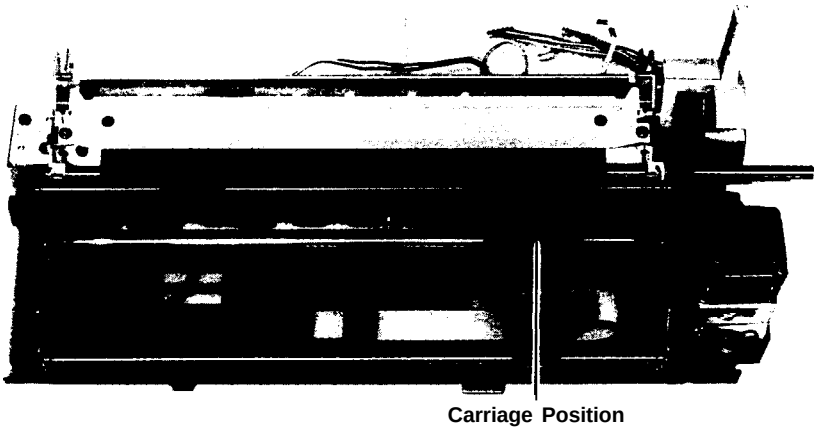


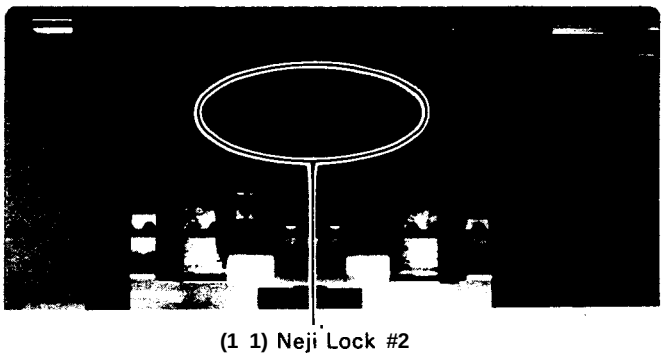
Figure 6-4. FX-105O Lubrication Points Diagram (2)

Table 6-3. Adhesive Application Point (Refer to Figure 6-5.)

Ref. No.	Adhesive Application Point
(11)	Engaging parts between timing belt and carriage



(a) Carriage Position



(b) Bottom View

Figure 6-5. Adhesive Application Point

APPENDIX

LIST OF FIGURES

LIST OF TABLES

A.1 IC DESCRIPTIONS

This section describes the primary ICs used in the FX-850/1050.

Table A-1. IC List (PEGX Board)

IC Name	Description	Part Number	IC Location
wPD7810HG	Main CPU	X4000780 10	4B
E05A15HA	Gate Array	Y46 1800002	3A
E05A16GA	Gate Array	Y46 1800003	7A
HM6264ALSP-15	ST-RAM 64K bit	X400662647	5A, 6A
STK6722H	Hybrid IC	X4406722 10	2A
NJ M2355	Switching Regulator	X440072350	1A

Table A-2 Transistor List

Transistor Name	Description	Part Number	Location
2SC3987	60±10V, 3A, 2W	X302398709	Q1-Q9, Q16
2SA1 450	80V,500mA,600mW	X300145009	Q1O, 12
2SC3748	60V, 10A	X302374809	Q11
2SC3746	60V, 5A	X302374609	Q13
2SB765K	120V, 3A, 1.5W	X301 O7653O	Q15
2SB1318	100V, 3A, 1.2W	X301131809	Q17
2SD560 (4)	120V, 5A, 1.5W	X303056009	Q18-Q21
2SC18 15	60V, 150mA, 400mW	X302181589	Q22, Q25, Q30
2SA1O 15	50V, 150mA, 400mW	x3 o o1 o 1 5o 9	Q23, Q24

A.1.1 CPU KPD781OHG

The μPD78 10/781 1 is an 8-bit CPU and includes two 8 bit timer counters, an 8-bit A/D converter, 256 bytes of RAM, and a serial interface. A system can be easily constructed using this IC. The main features of this IC are as follows.

- 256 bytes built-in RAM (addresses FFOOH-FFFFH)
- 4096 bytes maks ROM (addresses O-FFOOH) for the 7811 CPU
- Direct addressing of up to 64K bytes
- . 8-bit A/D converter
- 158 instructions
- 0.8 μs instruction cycle (15 MHz)
- 16-bit event counter
- Two 8-bit timer counters
- 3 external and 8 internal interrupts; 6 priority levels and 6 interrupt addresses.
- General purpose serial interface (asynchronous, synchronous, and I/O modes)
- I/O line (781 1 :40-bit I/O port; 78 10:24-bit edge detection, 4 inputs)
- Zero corss detection
- Standby function
- Built-in clock pulse circuit
- NMOS

Figures A-1 and A-2 illustrate the 78 10/781 1 HG microprocessor, and Tables A-3 through A-6 describe its functions.

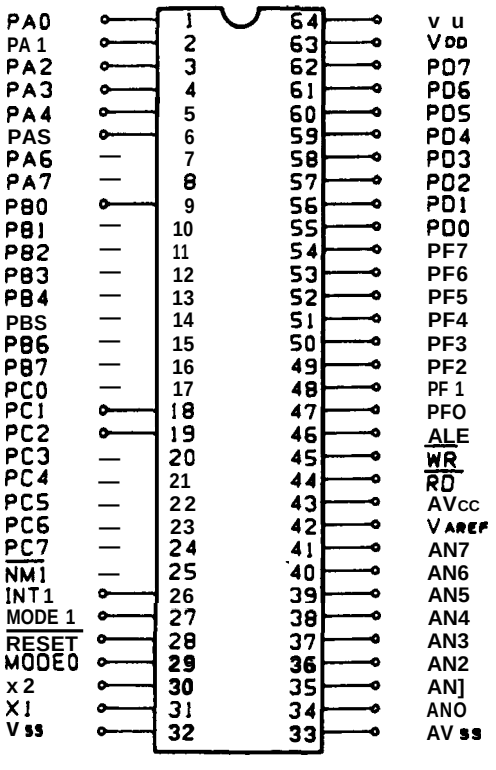


Figure A-1. KPD7810/7811 Pin Diagram

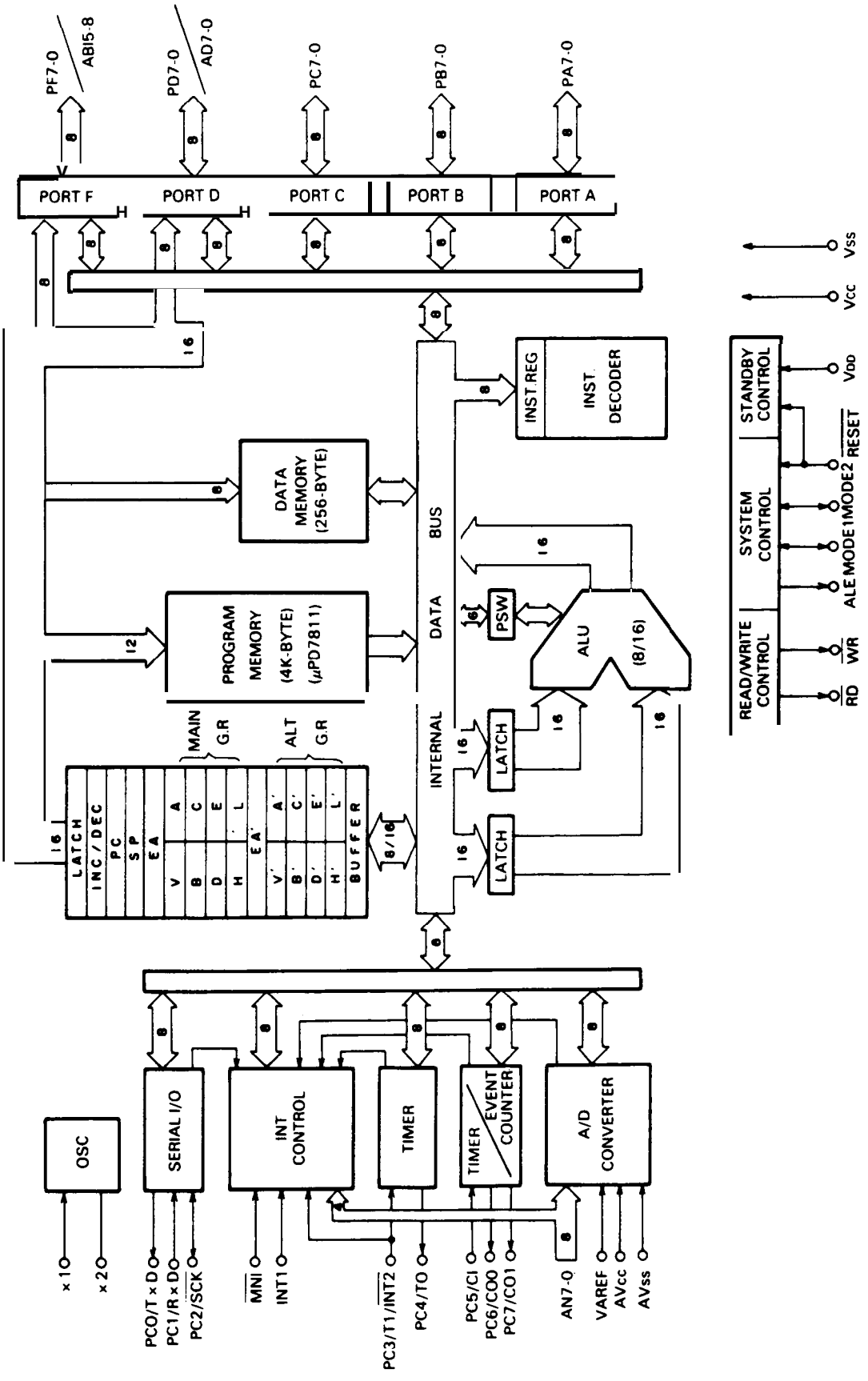


Figure A-2. μPD 7810/7811 Block Diagram

Table A-3. μPD781 O Mode Setting

Mode 1	Mode O	External memory
o	0	4K bytes, Addresses O to OFFF
o	1 (Note)	16K bytes Addresses O to 3FFF
1 (Note)	1 (Note)	64K bytes Addresses O to OFFF

NOTE: Pull-up is made.

Table A-4. μPD781 1 PF Operation

PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0	External Memory
Port	Port	Port	Port	Port	Port	Port	Port	256 bytes (max.)
Port	Port	Port	AB 11	AB 10	AB9	AB8	4K bytes	
Port	Port	AB 13	AB 12	AB 11	AB 10	AB9	AB8	16K bytes (max.)
AB 15	AB 14	AB 13	AB 12	AB 11	AB 10	AB9	AB8	60K bytes (max.)

Table A-5. μPD781 O PF Operation

MODE 1	MODE O	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0	External Memory
o	0	Port	Port	Port	Port	AB 11	AB 10	AB9	AB8	4K bytes max.)
o	1	Port	Port	AB 13	AB12	AB 11	AB 10	AB9	AB8	16K bytes (max.)
1	1	AB 15	AB 14	AB 13	AB 12	AB 11	AB 10	AB9	AB8	64K bytes (max.)

Table A-6. μPD781 0/781 1 Port Functions

Pin	Sginal	Direction	Descriptions
1-8	PAO-7	In/Out	Port A: Eight-bit I/O with output latch. I/O possible by mode A (MA) register. Output HIGH.
9-16	PBO-7	In/Out	Port B: Eight-bit I/O with output latch. I/O possible by mode B (MB) register. Output HIGH.
17-24	PCO-7	In/Out	Port C: Eight-bit I/O with output latch. Port/Control mode can be set by mode control C (MCC) register. Output HIGH
25	NMI	In	Non-maskable interrupt of the edge trigger (trailing edge).
26	INT 1	In	Maskable interrupt input of the edge trigger (leading edge). Also used as the AC input zero cross detecting terminal.
27, 29	MODE 1,0	In/Out	7811 :O=LOW and 1 =HIGH 7810 modes set in accordance with external memory (see Table A-2)
28	$\overline{\text{RESET}}$	In	LOW reset
30, 31	X2,X1	—	Crytal connection for built-in clock pulse. When clock pulses are supplied externally, input must be to X 1.
32	Vss	—	Supply voltage, Vss, OV
33	AVss	—	Analong Vss
34-41	ANO-7	In	Eight analog inputs of the A/D converter. AN7-4 can be used as the input terminals to the detect the leading edge and to set the test flag upon detection of the trailing edge.
42	VAref	In	Reference voltage
43	AVcc	—	Analog Vcc
44	RD	out	Read strobe. LOW at the read machine cycle and at reset, HIGH at other times.
45	WR	out	Write strobe. LOW during the write machine cycle and at reset, HIGH at other times.
46	ALE	out	Address latch enable. Latches the lower 8 address bits to access external memory.
47-54	PF0-7		Port F 78: 1 1: Port bit-by-bit I/O possible by mode F register. In extension mode gradual address output assignment is possible in accordance with the size of external memory. See Table A-3. 78 10: By setting modes O and 1, assignment to the address bus (AB 15-8) can be made in accordance with the size of the external memory. The remaining terminals can be used as I/O ports. See Table A-4.
55-62	PDO-7		Port D 781 1: Port bit-by-bit I/O possible. In extension mode, PD7-0 act as the multiplexed address/data but (AD7-0). 78 10: Multiplexed address/data bus to access external memory.
63	VDD	———	Supply voltage, VDD +5V
64	Vcc	———	Supply voltage, Vcc +5V

NOTE: “Direction” refers to the direction of signal flow as viewed from the CPU.

● CPU Timing

Refer to Figures A-3 through A-5 for CPU timing diagrams.

Three oscillations define one state. The OP code fetch requires four states; during TI to T3, program memory is read; instructions are interpreted during T4. Address bus lines 15-8 are output from T1 to T4. Address but lines 7-O (PD7-0) are used in the multiplex mode; the address is latched during T1 at the ALE signal. Since the memory addressed is enabled after disengaging the driver (AD7-0), $\overline{RD}$ is output from T1-T3, fetched at T3, and processed internally at T4. The ALE and RD signals are executed from T1-T3; the OP code fetch for these two signals is performed at T4. The WR signal is output from the middle of T 1 to the beginning of T3. The address and ALE timing is the same as that for memory read; however following address output AD7-0 (PD7-0) are not disabled, and write data is output at AD7-0 at the beginning of T1 and the end of T3.

NOTE: When PD7-0 are set to the multiplexed address/data-bus (AD7-0) to the address bus (AB7-0), the $\overline{RD}$ and WR signals in the machine cycle are HIGH when memory is not being accessed.

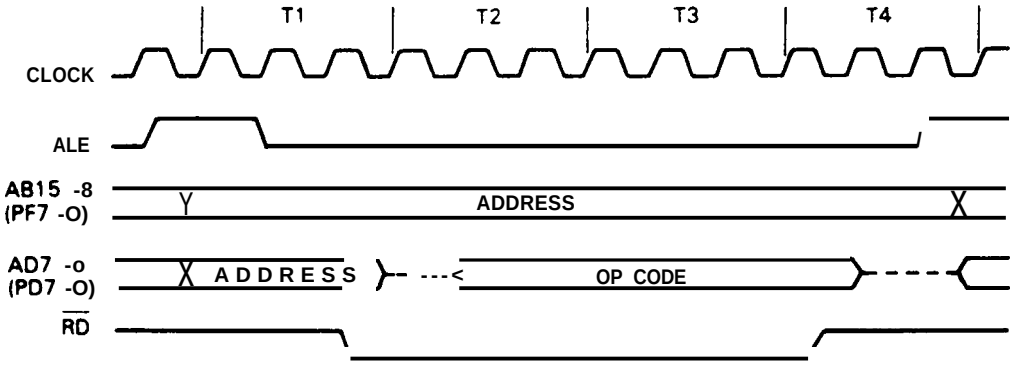


Figure A-3. OP Code Fetch Timing

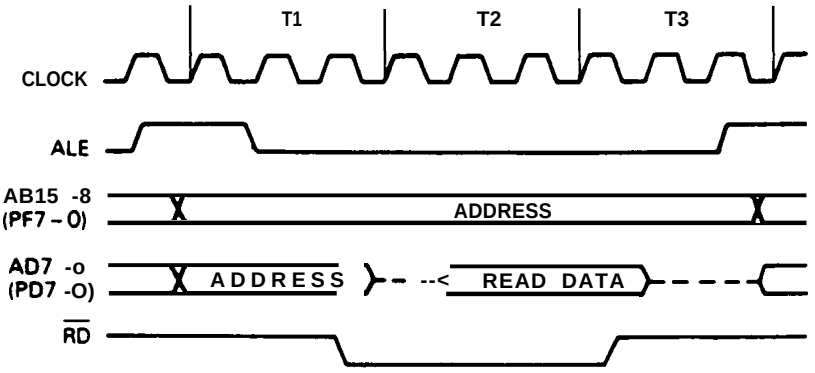


Figure A-4. Memory Read Timing

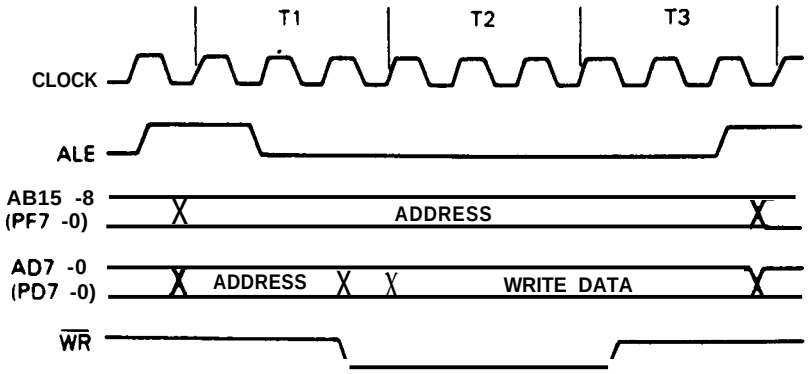


Figure A-5. Memory Write Timing

A.1.2 Gate Array E05A15HA

The E05A 15HA is a custom gate array used for address latching, address decoding, and automatic phase switching between two channels, and to control head data buffering. The features of this gate array are as follows:

- **Latches the low-order address for the μCOM87 series using the ALE signal.**
- **Since it has two buffers for print data and automatically activates the half-dot protection circuit, it can protect the printhead from damage due to programming mistake or a malfunction.**
- **Automatically switches the phases of the carriage motor and paper feed motor using the external clock signal.**

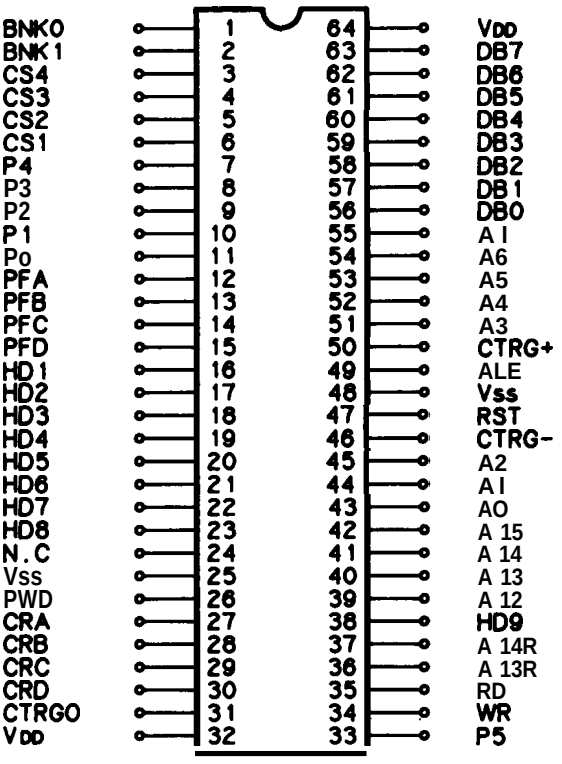


Figure A-6. GA E05A15HA Pin Diagram

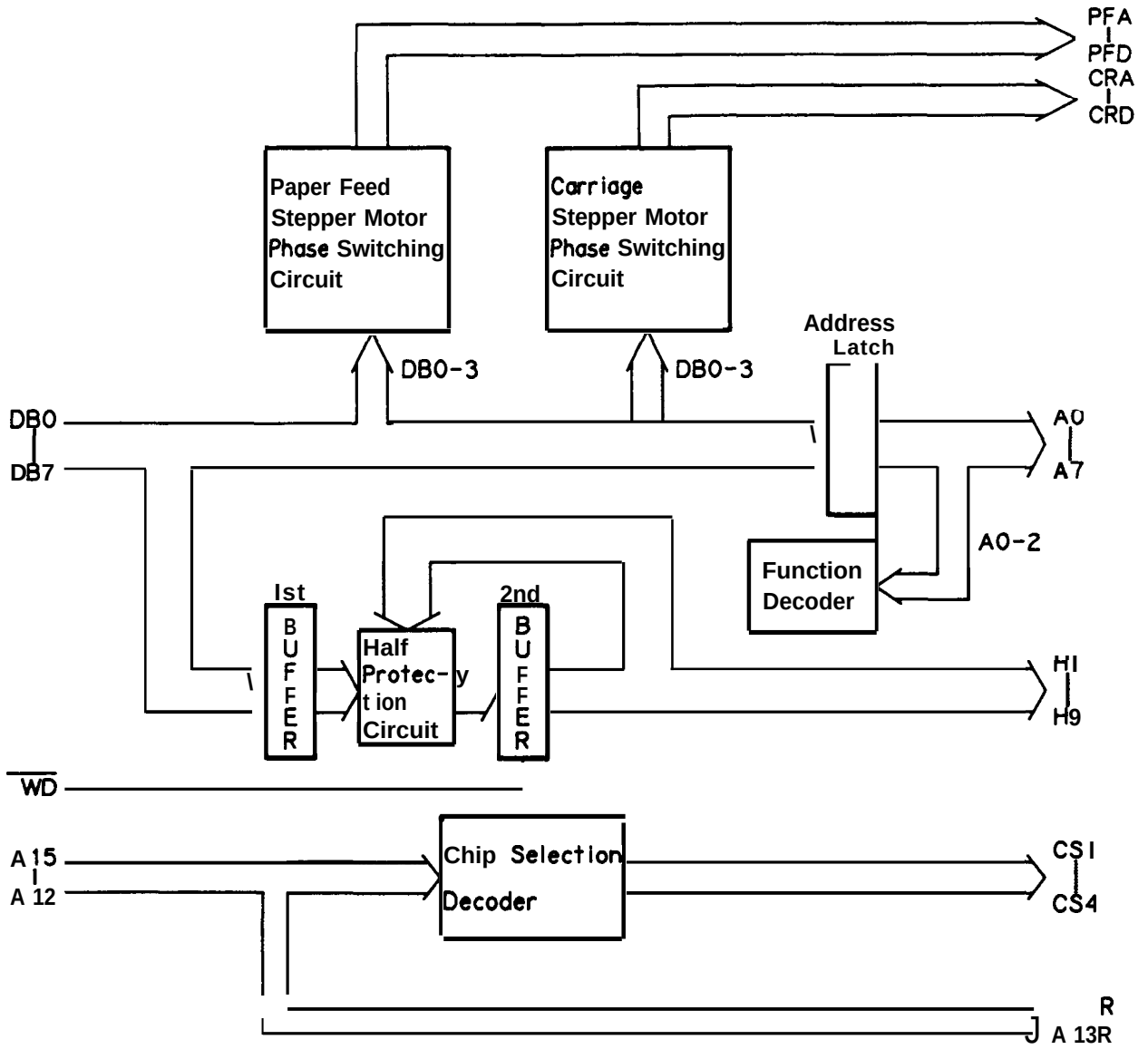


Figure A-7. GA **E05A15HA** internal Block Diagram

Table A-7 GA E05A15HA Port Functions

Pin No.	Signal Name	Direction	Function
1 2	BNK0 BNK1	OUT OUT	Bank Select signal
3 ∫ 6	CS4 ∫ CS1	OUT	Chip Select signal
7 ∫ 11	P4 ∫ Po	IN	Input Port
12 ∫ 15	PFA ∫ PFD	OUT	Motor Control Port (Paper Feed Motor)
16 ∫ 23	HD 1 ∫ HD8	OUT	Printhead Data Port
24			N.C
25	Vss		Ground
26	PWD	IN	Print Drive Pulse
27 ∫ 30	CRA ∫ CRD	OUT	Motor Control Port (Carriage Motor)
31	CTRG0	OUT	Cartridge output signal
32	V_{DD}		+5V
33	P5	OUT	output Port
34	WR	IN	Write Strobe signal
35	RD	IN	Read Strobe signal
36 37	AI 3R AI 4R	OUT	Address output signal
38	HD9	OUT	Printhead Data #9
39 ∫ 42	AI 2 ∫ AI 5	IN	Address Input signal
43 ∫ 45	AO ∫ A2	OUT	Address output signal
46	CTRG	IN	Cartridge signal (–)
47	RST	IN	Reset input signal
48	Vss		Ground
49	ALE	IN	Address Latch Enable signal
50	CTRG+	IN	Cartridge signal (+)

Table A-7. GA E05A15HA Port Functions (cent'd)

Pin No.	Signal Name	Direction	Function
51 ∫ 55	A3 ∫ A7	OUT	Address output signal
56 ∫ 60	DB0 ∫ DB4	IN/OUT	Input/Output Data Bus
61 ∫ 63	DB5 ∫ DB7	IN	Input Data Bus
64	V_{DD}		+5V

NOTE: "Direction" refers to the direction of signal flow as viewed from the gate array.

Table A-8. GA E05A15HA Control Functions

Address	READ/WRITE	Control Functions
OOH	READ	None
	WRITE	Data is set to the mode register. Bit 7: – Bit 6: Bank 1 Bit 5: Bank O Bit 4: Carriage motor rotation 1 ... Counterclockwise (L → R) O . . Clockwise (R + L) Bit 3: Carriage motor phase switching 1 ... Direct control O . . . Automatic control Bit 2: Paper feed motor rotation 1 ... Clockwise (Reverse) O . . . Counterclockwise (Forward) Bit 1: Paper feed motor phase switching 1 . . . Direct control O . . . Automatic control Bit O: Automatic half-dot protection 1 . . . Enable 2 . . . Disable
OIH	READ	Read data from PO-P4. Bit 7-5: Not used Bit 4: P4 Bit 3: P3 Bit 2: P2 Bit 1: P1 Bit O: PO
	WRITE	Write data to P5. Write P5 data to the mode register bit 5.
02H	READ	Clear 1st printhead data buffer.
	WRITE	Clear printhead data 9th bit → Head Data" bit 7
03H	READ	Clear 2nd printhead data buffer.
	WRITE	Set printhead data. 1st-8th bit → Head Data bits 7-O
04H	READ	Read paper feed motor phases. Bit 7-4: Not used Bit 3: A-phase Bit 2: C-phase Bit 1: B-phase Bit O: D-phase
	WRITE	Set paper feed motor phases Bit 7-7: Not used Bit 3: A-phase Bit 2: C-phase Bit 1: B-phase Bit O: D-phase

Table A-8. GA E0515HA Control Functions (cent'd)

Adress	READ/WRITE	Control Functions
05H	READ	Read carriage motor phases. Bit 7-4: Not used Bit 3: A-phase Bit 2: C-phase Bit 1: B-phase Bit O: D-phase
	WRITE	Set carriage motor phases. Bit 7-4: Not used Bit 3: A-phase Bit 2: C-phase Bit 1: B-phase Bit O: D-phase

A.1.3 Gate Array E05A16GA

The E05A 16GA is a custom gate array used to implement the following functions.

- **Super/subscript generator converts the normal CG pattern (image data) received from an external device into super/subscript character data.**
- **Italic character generator converts the normal CG pattern (image data) received from an external device into italic character data.**
- **24-bit shift register.**
- **8-bit parallel interface. Automatically latches the data upon receiving the strobe signal, and sets the BUSY signal HIGH. inputs and outputs other control signals.**
- **When a serial interface is used, multiplexes the two receive data lines (RXD and the seventh bit of the 8-bit parallel interface) using internal logic, and outputs the result to an external device.**
- **Logically ANDs the two external reset signal inputs using internal logic, and output the result to an external device (one-channel).**
- **Output ports with different types of output.**
- **General purpose input port.**
- **Bi-directional 8 bit data bus.**

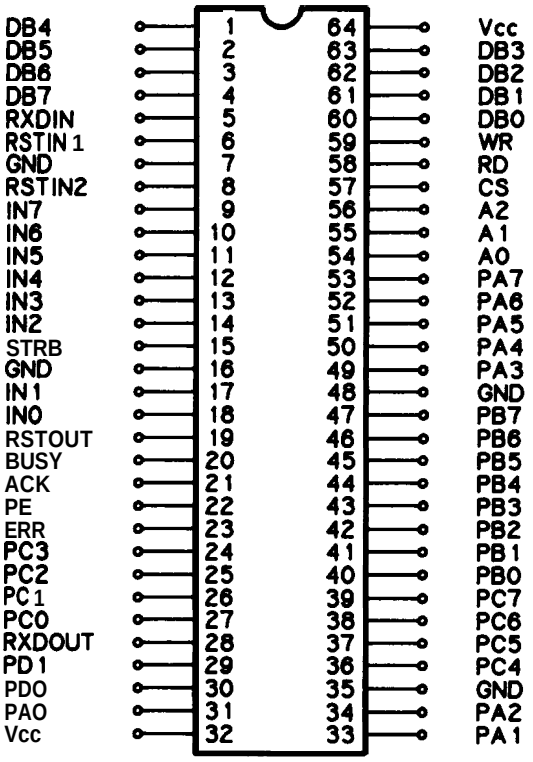


Figure A-8. GA E05A16GA Pin Diagram

Figure A-9 shows the gate array block diagram and Table A-9 lists the gate array ports function.

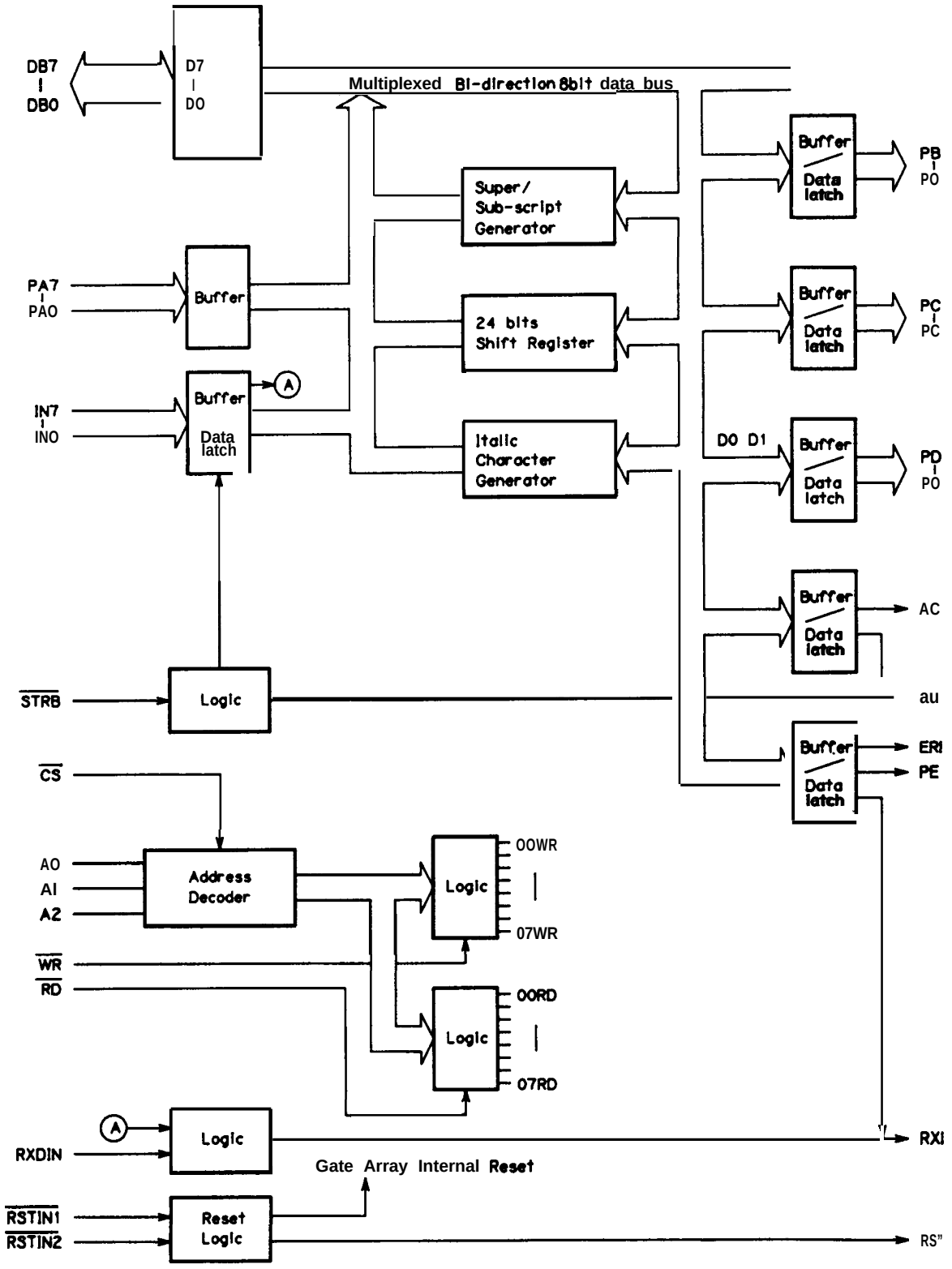


Figure A-9. GA E05A16GA Internal Block Diagram

Table A-9. GA E05A16GA Port Functions

Pin No.	Signal Name	Direction	Function
1 ∫ 4	DB4 ∫ DB7	IN/OUT	Multiplex tri-state data bus bit 4-7 The data is output when RD signal is low.
5	RXDIN	IN	RXD signal input port
6	RSTIN1	IN	Reset signal input No. 1 RSTIN 1 signal is output to RSTOUT signal port.
7	Vss	-	Ground
8	RSTIN	IN	Reset signal input No.2 RSTIN 2 signal is output to RSTOUT signal port.
9 ∫ 14	IN7 ∫ IN2	IN	Parallel data input port The data from the host computer is latched when the strobe signal is input.
15	STRB	IN	Strobe signal input port The parallel data from host computer is latched by STRB signal.
17 18	IN 1 I NO	IN	Parallel data input port. The data from the host computer is latched when the strobe signal is input.
19	RSTOUT	OUT	Reset signal output port
20	BUSY	OUT	Busy signal output port
21	ACK	OUT	Acknowledge signal output port
22	PE	OUT	Paper end signal output port
23	ERR	OUT	Error signal output port
24 ∫ 27	PC3 ∫ PCO	OUT	output port
28	RXDOUT	OUT	Serial data output port
29 30	PD1 PDO	OUT	output port
31	PAO	IN	input port
32	VDD	—	+5V
33 34	PA1 PA2	IN	Input port
35	Vss	—	
36 ∫ 39	PC4 ∫ PC7	out	output port
40 ∫ 47	PBO ∫ PB7	OUT	output port
48	ss	-	Ground
49 ∫ 53	PA3 ∫ PA7	IN	Input port
54 ∫ 56	AO ∫ A2	IN	Address input port (low address bit O-2)

Table A-9. GA E05A16GA Port Functions (cent'd)

Pin No.	Signal name	Direction	Function
57	Cs	IN	Chip select signal
58	RD	IN	Read strobe signal
59	WR	IN	Write strobe signal
55 ∫ 63	DB0 ∫ DB3	IN/OUT	Multiplex tri-state data bus bit 0-3 The data is output when RD signal is low.
64	VDD	IN	+ 5V

NOTE1: "Direction" refers to the direction of signal flow as viewed from the gate array.

This gate array is accessed by READing and WRITEing the memory mapped I/O addresses (MM IO) using the internal address decoder. The MMIO Ports for this gate array are 00H to 07H, accessed by the lower three bits (AO to A2) of the address bus. Table A-1 O shows the operation of the memory mapped I/O addresses.

Table A-10. GA E05A16GA Control Functions

MMI/O Address	READ/ WRITE	Control Functions
00H	READ	PA7-O → DB7-0 (Read) The data is inverted.
	WRITE	DB7-0 → PB7-O (Write) The data is inverted.
01 H	READ	IN7-0 → DB7-0 (Read) The data is inverted.
	WRITE	DB7-0 → PC7-O (Write) The data is inverted except bit O and 1.
02H	READ	Read hard-ware BUSY signal (DBO) When DBO is high, parallel data is latched in gate array.
	WRITE	Write interface parameter to interface control port. Bit 7: Print data O: "1" bit is print data; 1: "O" bit is print data. Bit 6: Acknowledge signal O: inactive state 1: active state Bit 5: Busy signal O: High level is active state. 1: Low level is active state. Bit 4: Software Busy signal O: Software Busy state. 1: Ready state. Bit 3: ERR signal O: inactive state. 1: active state. Bit 2: PE signal O: inactive state. 1: active state. Bit 1: Serial data input selection. O: IN7. 1 : RX DIN. Bit O: Parallel data latch timing. O: Rising edge of STRB. 1: Falling edge of STRB.
03H	READ	Read the converted Italic CG data. The data is shifted at the falling edge of the RD signal.
	WRITE	
04H	READ	Shift out the MS bit of the 24 bits shift register. MSB24 → DB7 The data is shifted at the rising edge fo RD signal.
	WRITE	Load shift register. 1st: DB7-0 → Bit 23-16 2nd: DB7-0 → Bit 15-8 3rd: DB7-0 → Bit 7-O

Table A-1 O. GA E05A16GA Control Functions (cent'd)

05H	READ	Read the 9th pin data of the Super/Subscript generator. Interface parameter bit 7 → DB7
	WRITE	Write the 9th pin data to the Super/Subscript generator. DB7 → 9th pin data of the Super/Subscript generator.
06H	READ	Read 8 bits data from the Super/Subscript generator. 8 bits data of the Super/Subscript generator → DB7-O.
	WRITE	Write 8 bits data to the Super/Subscript generator. DB7-0 → Super/Subscript generator.
07H	READ	Read data from the parallel data latch. IN7-0 → DB7-0
	WRITE	Write data to the Super/Subscript generator and port D. DB 1-2 → PD 1-2

This gate array logically ANDs the two external reset signal inputs using internal logic, then outputs the result to an external device (one-channel) and resets the ports internally. Table A-1 1 shows the port settings after they are reset.

Table A-1 1. GA E05A16GA Initialized State

Port	Setting
Port B (PB7-PB0)	High
port C (PC7-PB2) (PC1-PC0)	Low High
Port D (PD 1) (PD0)	High Low
Interface control port (except bit 2)	Low (0)
Hard-ware BUSY signal	Low (Ready)

A.1.4 HM27256G-25 EP-ROM

This EP-ROM is a ultra-violet erasable and electrically programmable ROM of 32 K-bytes.

Features

- **Capacity of 32768 words X 8 bits**
- **I/O with TTL compatible**
- **Power supply +5V DC**
- **Access time 250 ns**
- **28 pins (DIP)**

Terminal Functions

- **AO - Al 4 Input address**
- **= Chip enable**
- **OE Output enable**
- **DO - D7 Input/Output data**

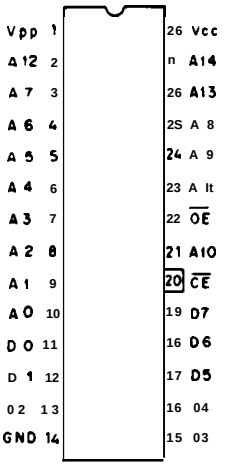


Figure A-10. HM27256G-25 Pin Diagram

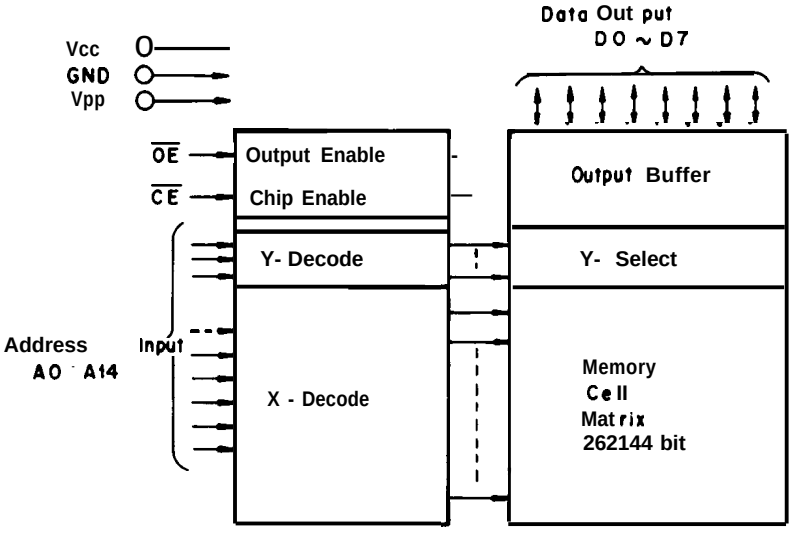


Figure A-1 1. HM27256G-25 EP-ROM Block Diagram

Table A-1.7. HM27256 EP-ROM Signal Status

Mode	$\overline{CE}$	$\overline{OE}$	A9	V_{PP}	Vcc	outputs
Read	L	L	x	Vcc	Vcc	D out
Output Disable	L	H	x	Vcc	Vcc	High Z
Standby	H	x	x	Vcc	Vcc	High Z
High Performance Program	L	H	x	Vpp	Vcc	D in
Program Verify	H	L	X	Vpp	Vpp	D out
Optional Verify	L	L	x	Vpp	Vpp	D out
Program Inhibit	H	H	x	Vpp	Vcc	High Z
Identifier	L	L	V_H	Vcc	Vcc	Code

NOTES: 1. X . . . Don't care

2. VH = 12.OV ± 0.5V
3. Vcc = −0.6 - +7V
4. Vpp = −0.6 - + 14V

A.1.5 HM6264ALSP-12 CMOS ST-RAM

This is a 8K-byte CMOS static RAM which has low power consumption, and its input/output level is compatible with the TTL ICs.

Features

- **Capacity of 8192 words × 8 bits**
- **1/0 with TTL compatible**
- **Power supply +5V DC**
- **$\overline{CS}$ access time . . . 120ns**
- **28 pins (DIP)**

Functions

- **AO - Al 2 Input address**
- **WE Write enable**
- **w Output enable**
- **. $\overline{CS1}$, CS2 Chip select**
- **DO - D7 Input/Output data**
- **NC No connection**

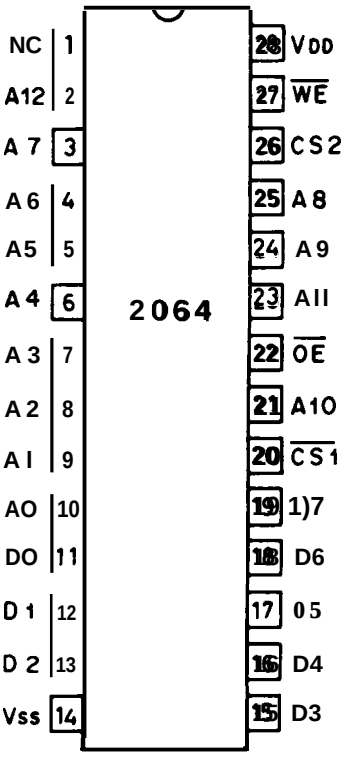


Figure A-1 2. HM6264ALSP-12 Pin Diagram

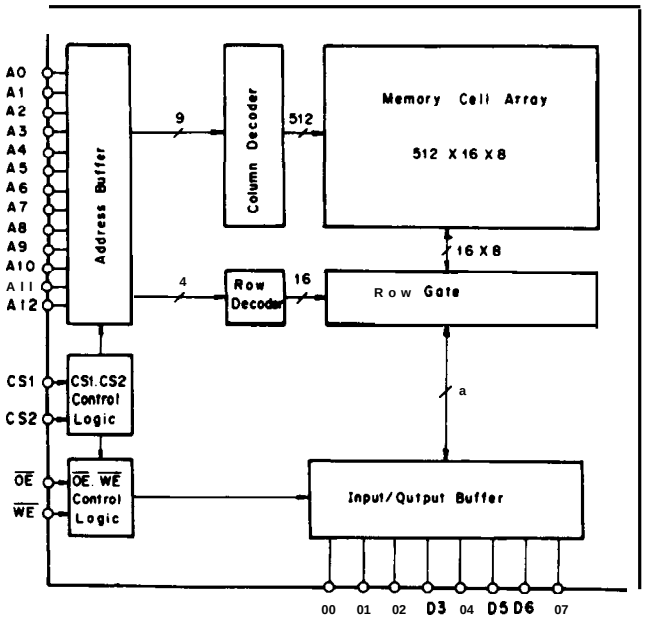


Figure A-1 3. HM6264ALSP-12 Block Diagram

Table A-1 3. HM6264ALSP-12 Signal Status

WE	CS1	CS2	OE	I/O Terminal	Mode
X	H	X	X	High Z	Power down
H	L	H	H	High Z	Output disable
H	L	H	L	Data out	Read cycle
L	L	H	H	Data in	Write cycle (1)
L	L	H	L	Data in	Write cycle (2)

A.1.6 NJ M2355

The NJ M2355 function is identical to the TL949 functions. It is a pulse-width modulation control circuit IC.

Figure A-1 4 shows the NJ M2355 internal circuit diagram.

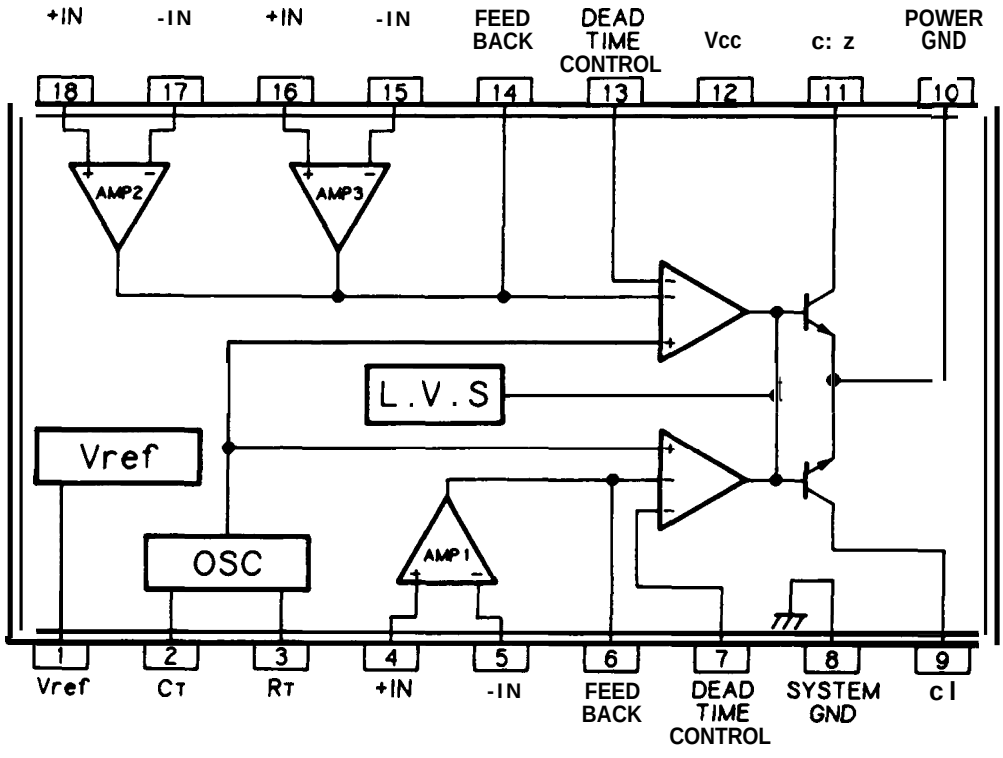


Figure A-14. NJM2355 Internal Circuit Diagram

A.1.7 STK6722H 4-Phases Stepper Motor Driver

The STK6722H is an uni-polar constant current chopper driver IC for the four phases stepper motor.

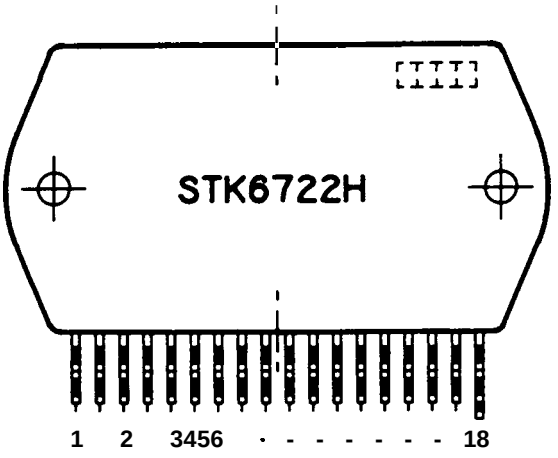


Figure A-1 5. STK6722H Pin Diagram

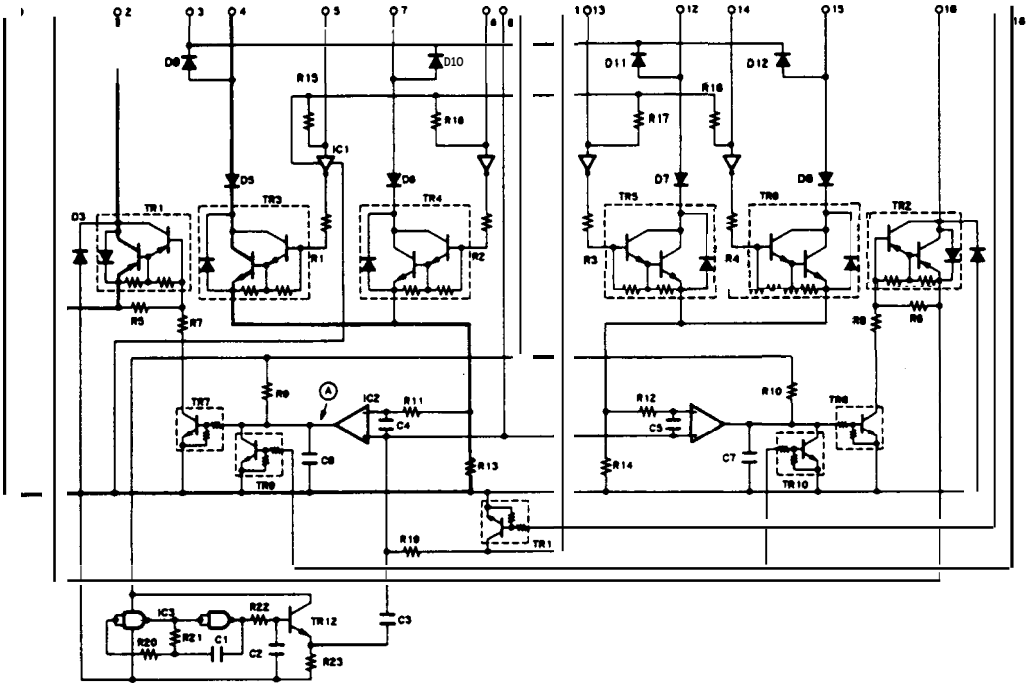


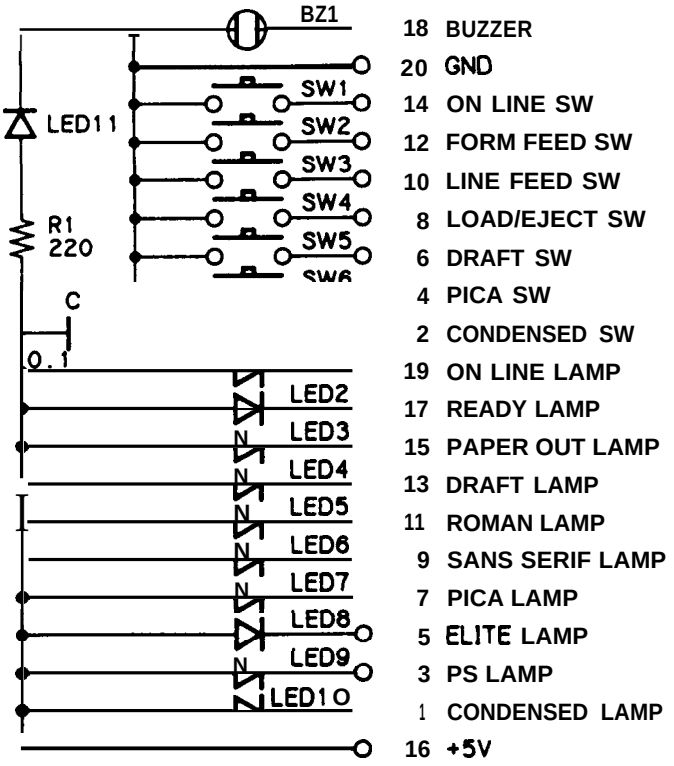
Figure A-1 6. STK6722H Internal Circuit

Table A-14. STK6722H Terminal Function

Pin No.	Signal	Direction	Function
1	Vcc1	In	+35V DC power
2	CAB	out	CR motor phases A and B common
3	S.out	out	Surge voltage of CR motor coils
4	OA	out	CR motor phase A drive
5	1A	In	CR motor phase A drive pulse
6	IB	In	CR motor phase B drive pulse
7	OB	out	CR motor phase B drive
8	Vref	In	Reference voltage for CR motor phases
9	Vcc2	In	+ 5V DC (internal circuit power)
10	Vss	—	GND
11	N.C	—	Not connected
12	Oc	out	CR motor phase C drive
13	IC	In	CR motor phase C drive pulse
14	ID	In	CR motor phase D drive pulse
15	OD	out	CR motor phase D drive
16	C CD	out	CR motor phases C and D common
17	P.D.	In	Power down
18	Rush	—	Fixed to low

A.2 EXPLODED DIAGRAMS AND SCHEMATICS

Figure A-1 7 through A-27 are exploded and schematic diagrams.



PGPNL BOARD (Control Panel)
Y461 501000
Figure A-1 7. PGPNL Board Circuit Diagram

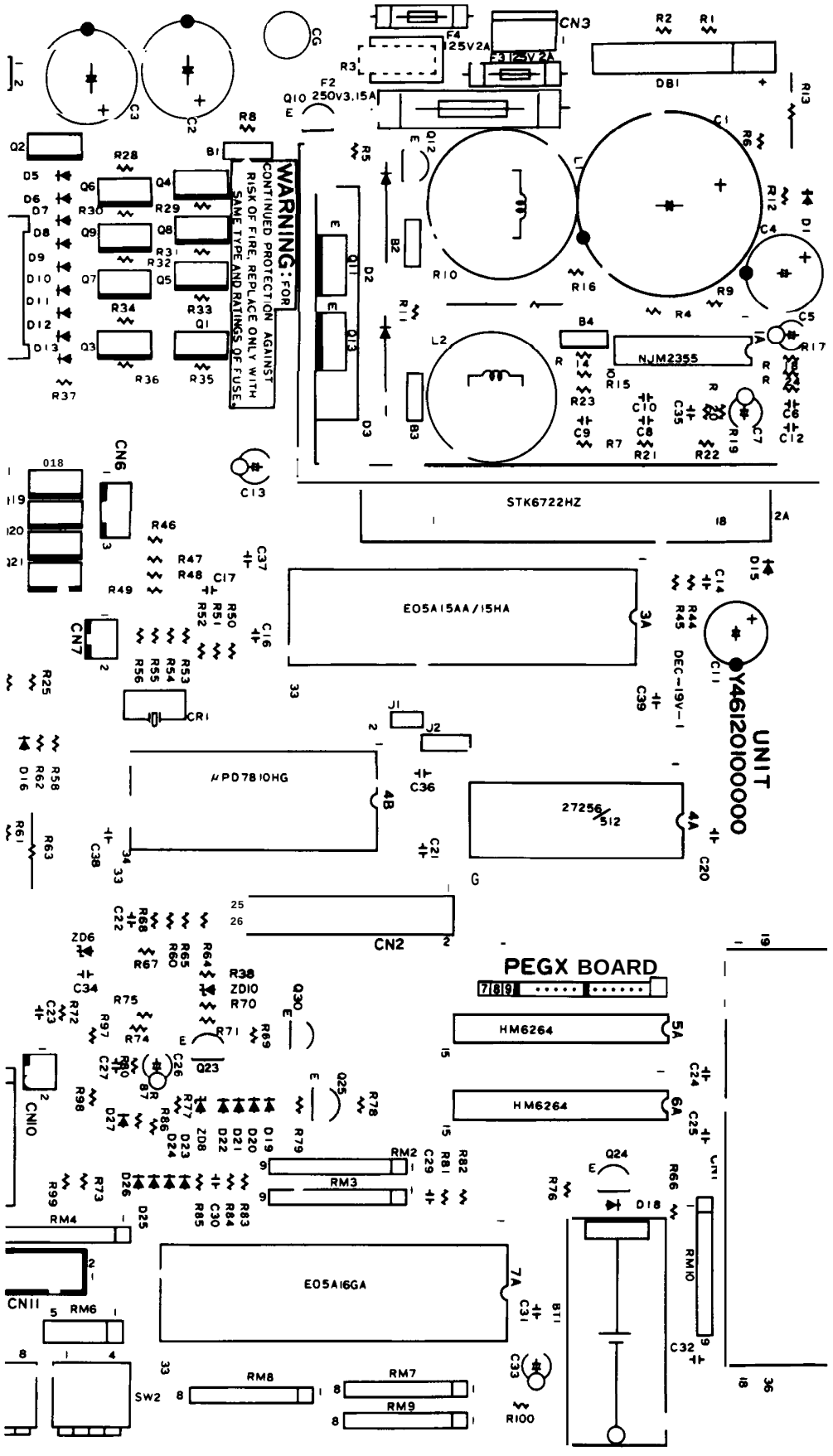


Figure A-19. PEGX Board Component Layout

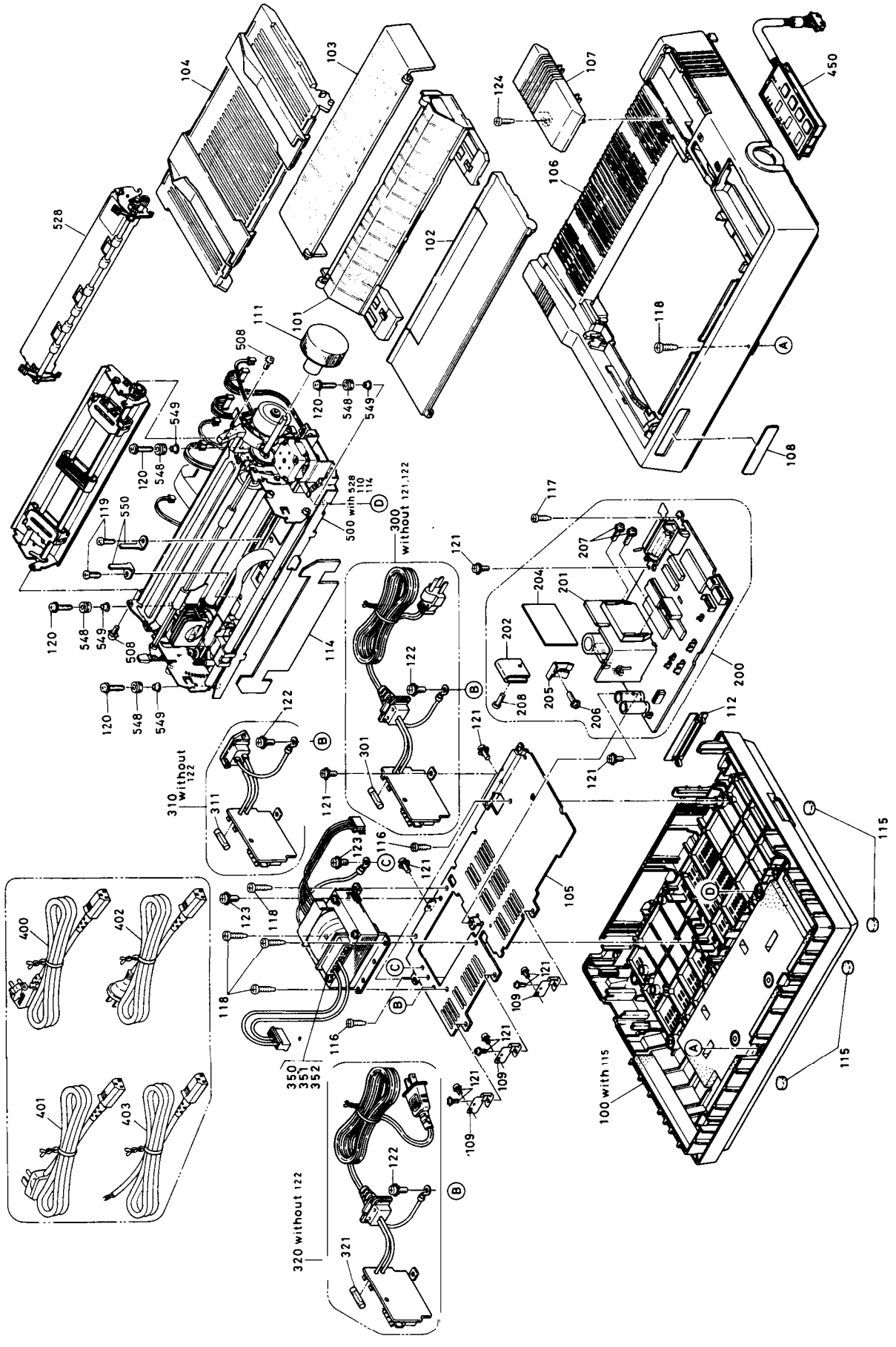


Figure A-20. FX-850 Exploded Diagram (1)

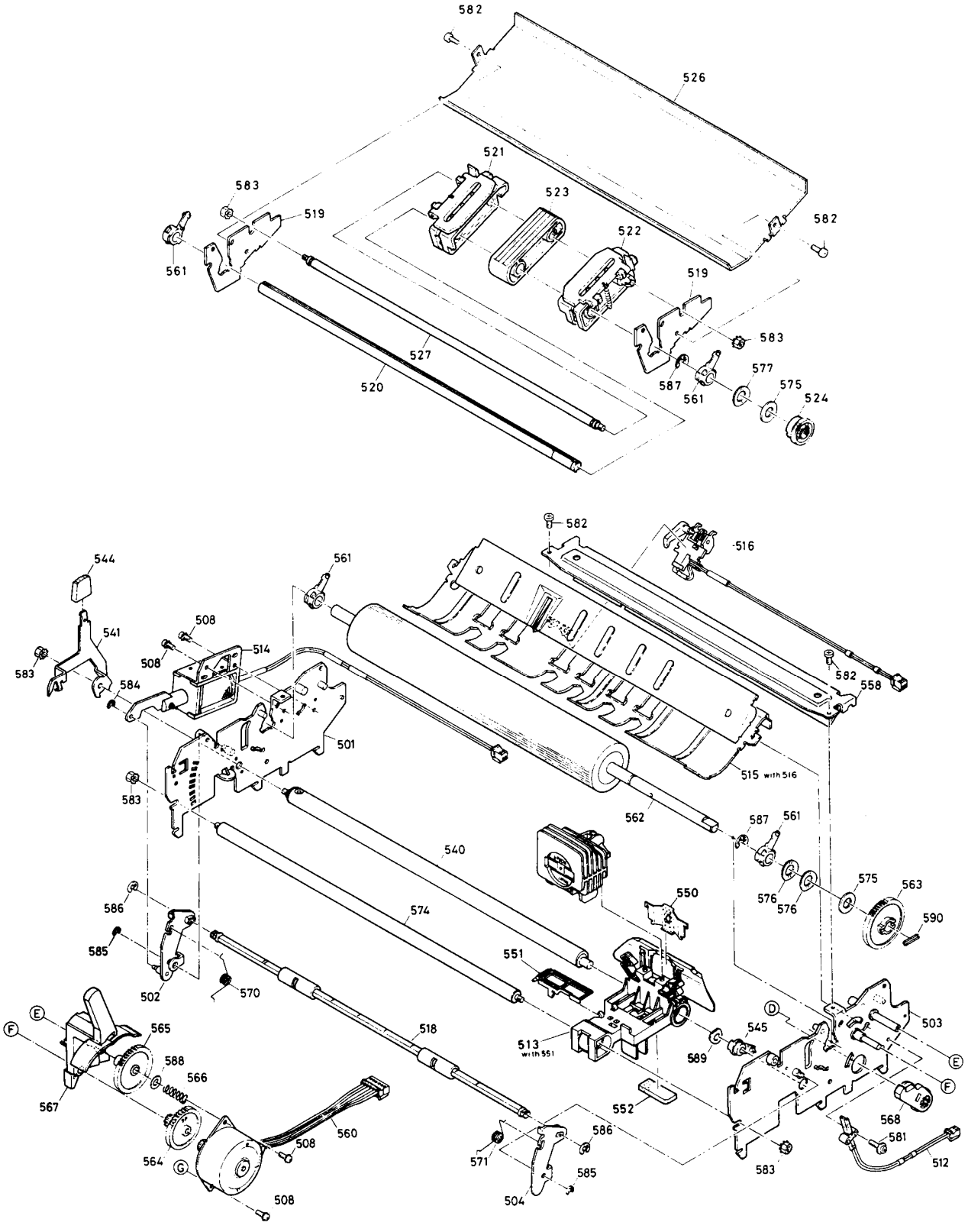


Figure A-21. FX-850 Exploded Diagram (2)

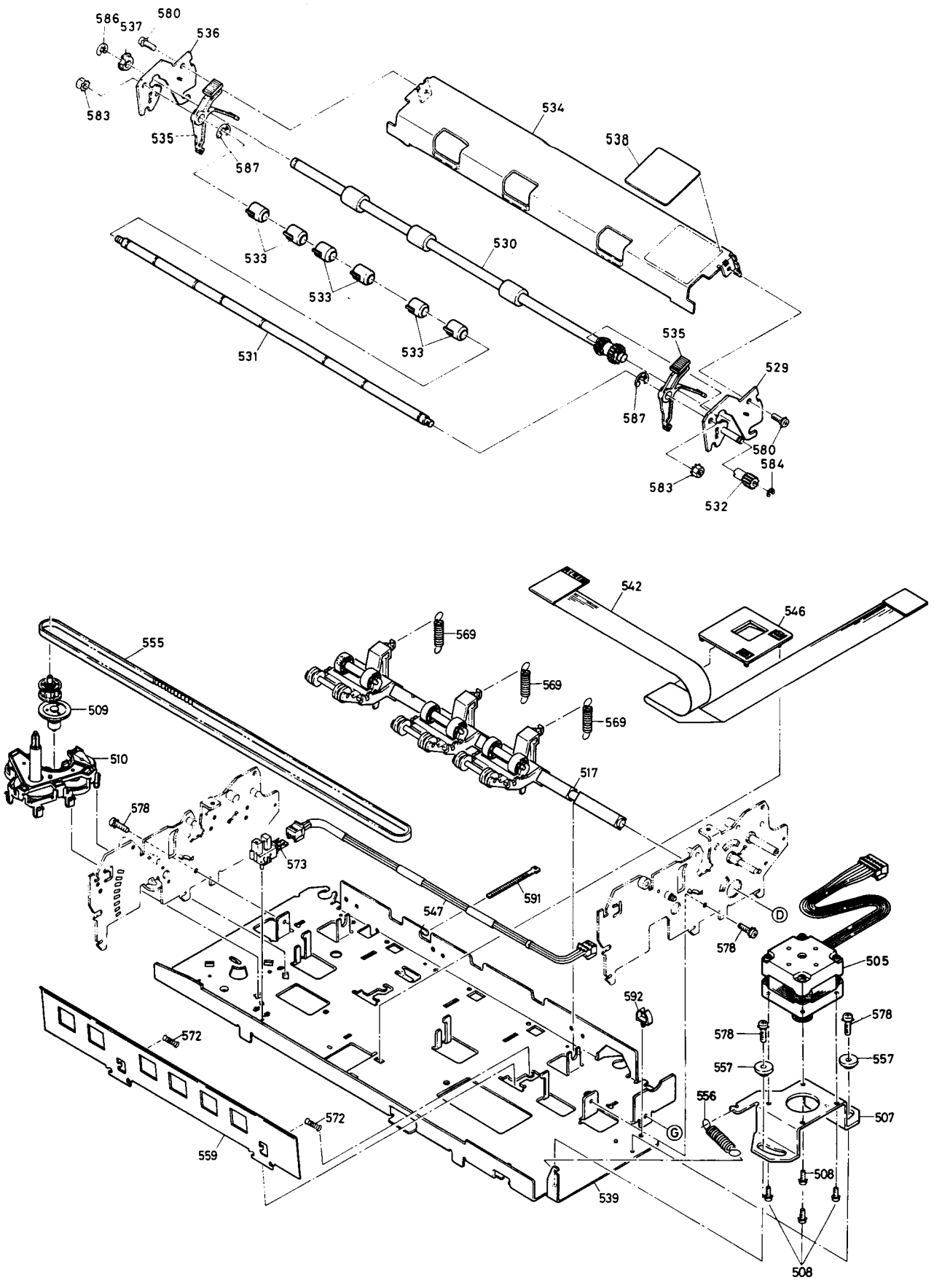


Figure A-22. FX-850 Exploded Diagram (3)

Table A-26. FX-850 Parts Name Reference

Ref No.	Description		Ref No.	Description	
100	LOWER CASE		523	PAPER SUPPORT	
101	PRINTER COVER A		524	TRACTOR GEAR	
102	PRINTER COVER B		526	TRACTOR UNIT COVER	
103	SHEET GUIDE COVER		527	SPROCKET GUIDE SHAFT	
104	SHEET GUIDE ASSEMBLY		528	PAPER TENSION UNIT	
105	BASE PLATE		529	PAPER TENSION FRAME (RIGHT)	
106	UPPER CASE		530	PAPER TENSION ROLLER SHAFT ASSEMBLY	
107	SIDE COVER		531	PAPER TENSION SUPPORT ROLLER SHAFT	
108	LOGO PLATE		532	PAPER TENSION ROLLER TRANSMISSION GEAR	
109	GROUND PIATE		533	PAPER TENSION SUPPORT ROLLER	
111	PLATEN KNOB		534	PAPER TENSION UNIT COVER	
112	SHIELD PLATE		535	PAPER TENSION LOCK LEVER	
115	RUBBER FOOT		536	PAPER TENSION FRAME (LEFT)	
116	C.B.B. SCREW	M3×8	537	PRINT WHEEL SHAFT HOLDER	
117	C.B.B. SCREW	M3×10	538	PAPER GUIDE LABEL	
118	C.B.B. SCREW	M4 X 12	539	BASE FRAME	
119	C.B.B. SCREW	M4 X 12	540	CARRIAGE GUIDE SHAFT B	
120	C.B.B. (P) SCREW	M4 X 25	541	HEAD ADJUSTMENT LEVER	
121	C.P.S. (0) SCREW	M3 X 6	542	CARRIAGE GUIDE SHAFT B	
122	C.B.". SCREW	M4 X 8	544	HEAD ADJUSTMENT BUSH	
123	C. B.S.(O) SCREW	M4 X 8	545	PARALLEL ADJUSTMENT BUSH	
124	C.B.P. SCREW	M3 X 8	546	HEAD CABLE HOLDER	
200	PEGX BOARD UNIT		547	HOME POSITION SENSOR CABLE	
201	HEAT SINKER	M38 1-010	548	DAMPER	
202	HEAT SINKER	M395-050	549	DAMPER SPACER	
204	INSULATOR	M38 1-020	550	TRANSPORT LOCKING BRACKET	
205	TRANSISTOR HOLDER	M903-108O	551	HEAD CABLE GUIDE	
206	C.C.S. SCREW	M3×12	552	OIL PAD	
207	C.C.S. SCREW	M3×16	533	RIBBON MASK	
208	C.C.S. SCREW	M3×10	555	TIMING BELT	
300	PEBFIL-II BOARD UNIT	120V	556	TIMING BELT TENSION SPRING	
301	FUSE	125V 2A	557	CARRIAGE MOTOR MOUNTING PLATE BUSH	
310	PEBFIL-II BOARD UNIT	220V/240V	558	PLATEN COVER	
311	FUSE	250V 1.25A	559	PAPER GUIDE PLATE	
320	PEBFIL-II BOARD UNIT	100V	560	PAPER FEED MOTOR	
321	FUSE	125V 2A	561	PLATEN SHAFT HOLDER	
350	POWER TRANSFORMER	120V	562	PLATEN	
351	POWER TRANSFORMER	220V	563	PLATEN GEAR	
352	POWER TRANSFORMER	240V	564	PAPER FEED REDUCTION GEAR	
400	POWER CABLE	220V	565	TRACTOR REDUCTION GEAR	
401	POWER CABLE	240V	566	TRACTOR REDUCTION GEAR SPRING	
402	POWER CABLE	240V	567	PAPER RELEASE LEVER	
403	POWER CABLE	240V	568	SUB PAPER RELEASE LEVER	
450	PGPNL BOARD		569	PAPER FEED SPRING	
500	PRINTER MECHANISM M-3B 10		570	PAPER HOLDING LEVER SPRING (LEFT)	
501	FRAME (LEFT)		571	PAPER HOLDING LEVER SPRING (RIGHT)	
502	PAPER HOLDING LEVER (LEFT)		572	PAPER GUIDE PLATE SPRING	168-410
503	FRAME (RIGHT)		573	HOME POSITION SENSOR	
504	PAPER HOLDING LEVER (RIGHT)		574	CARRIAGE SHAFT A	
505	CARRIAGE MOTOR		575	PLAIN WASHER	8X0.5 X 15
507	CARRIAGE MOTOR MOUNTING PLATE		576	LEAF SPRING	8.2×0.2×15
508	C.P.S. (0) SCREW	M3×6	577	.EAF SPRING	8.2x O. 15 X 15
509	BELT DRIVEN PULLEY ASSEMBLY		578	C.P.S. (0) SCREW	M3×10
510	RIBBON DRIVE ASSEMBLY		580	C.P.S (0) SCREW	M3×8
512	FLUCTION/TRACTOR SENSOR		581	C.P.S. (P) SCREW	M3×10
513	CARRIAGE UNIT		582	C.B(N).S. SCREW	M3×6
514	PLUNGER ASSEMBLY		583	HEXAGON NUT WITH OW	M4
514	PAPER GUIDE UNIT		584	RETAINING RING	TYPE-E(2.3)
516	PAPER END SENSOR		585	RETAINING RING	TYPE-E(3)
517	PAPER FEED ROLLER ASSEMBLY		586	RETAINING RING	TYPE-E(4)
518	PAPER HOLDING ROLLER ASSEMBLY		587	RETAINING RING	TYPE-E(5)
519	TRACTOR FRAME		588	PLAIN WASHER	5 XO.3X 10
520	TRACTOR SHAFT		589	.EAF SPRING	6 XO. 15 X 11
521	TRACTOR ASSEMBLY (LEFT)		590	SPRING PIN	2x 14
522	TRACTOR ASSEMBLY (RIGHT)		591	WIRE BAND	SKB-1M
			592	/1111 CLAMP	

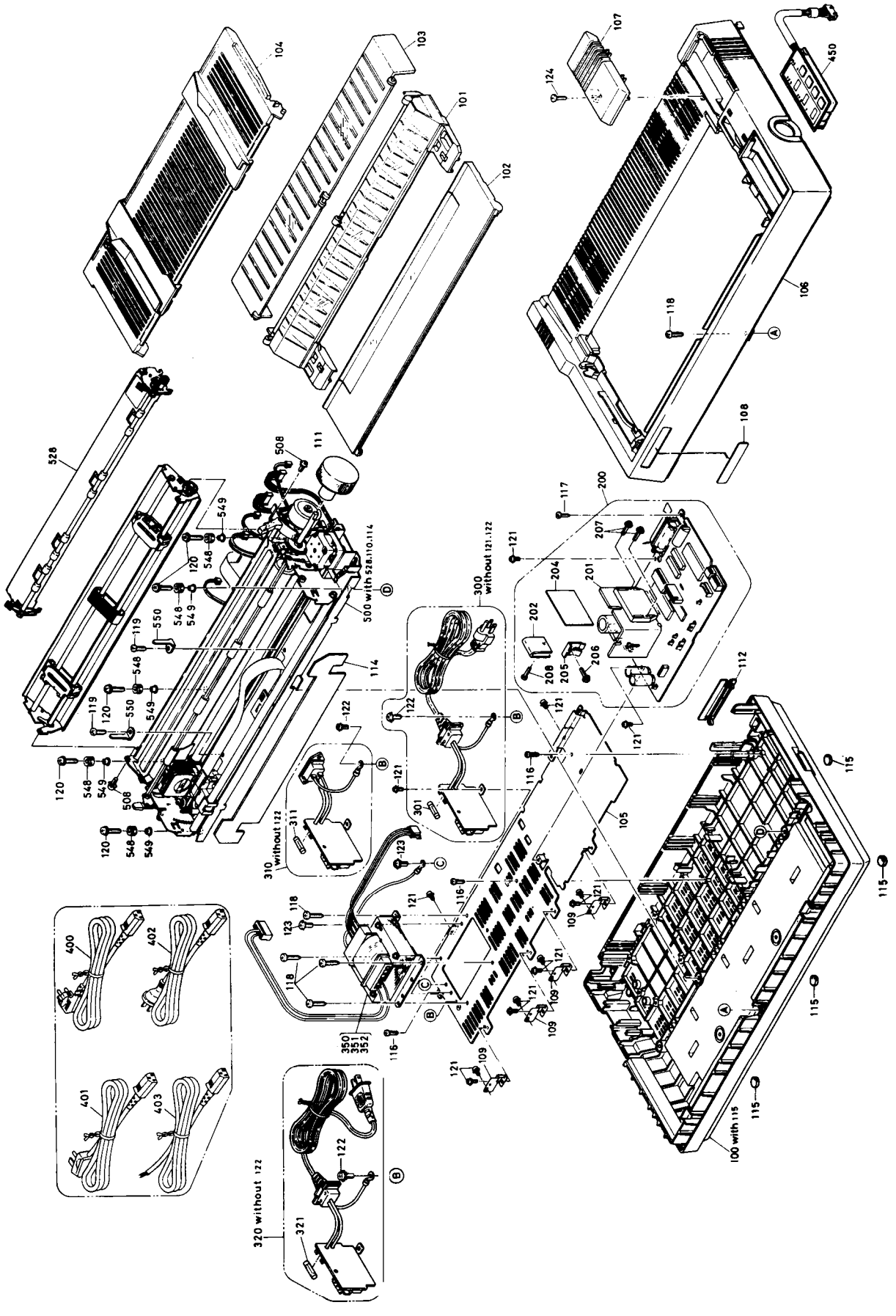


Figure A-23. FX-105O Exploded Diagram (1)

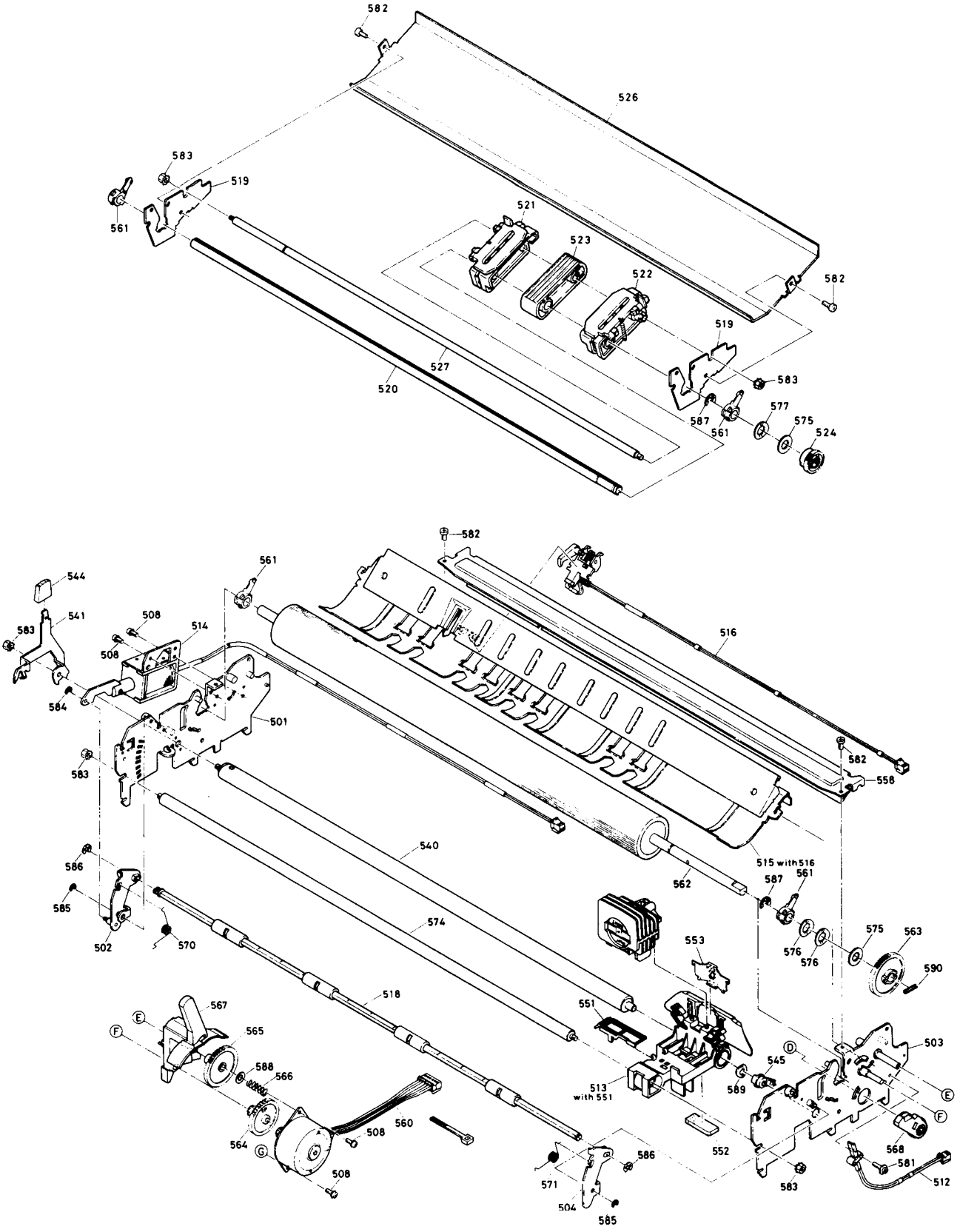


Figure A-24. FX-105O Exploded Diagram (2)

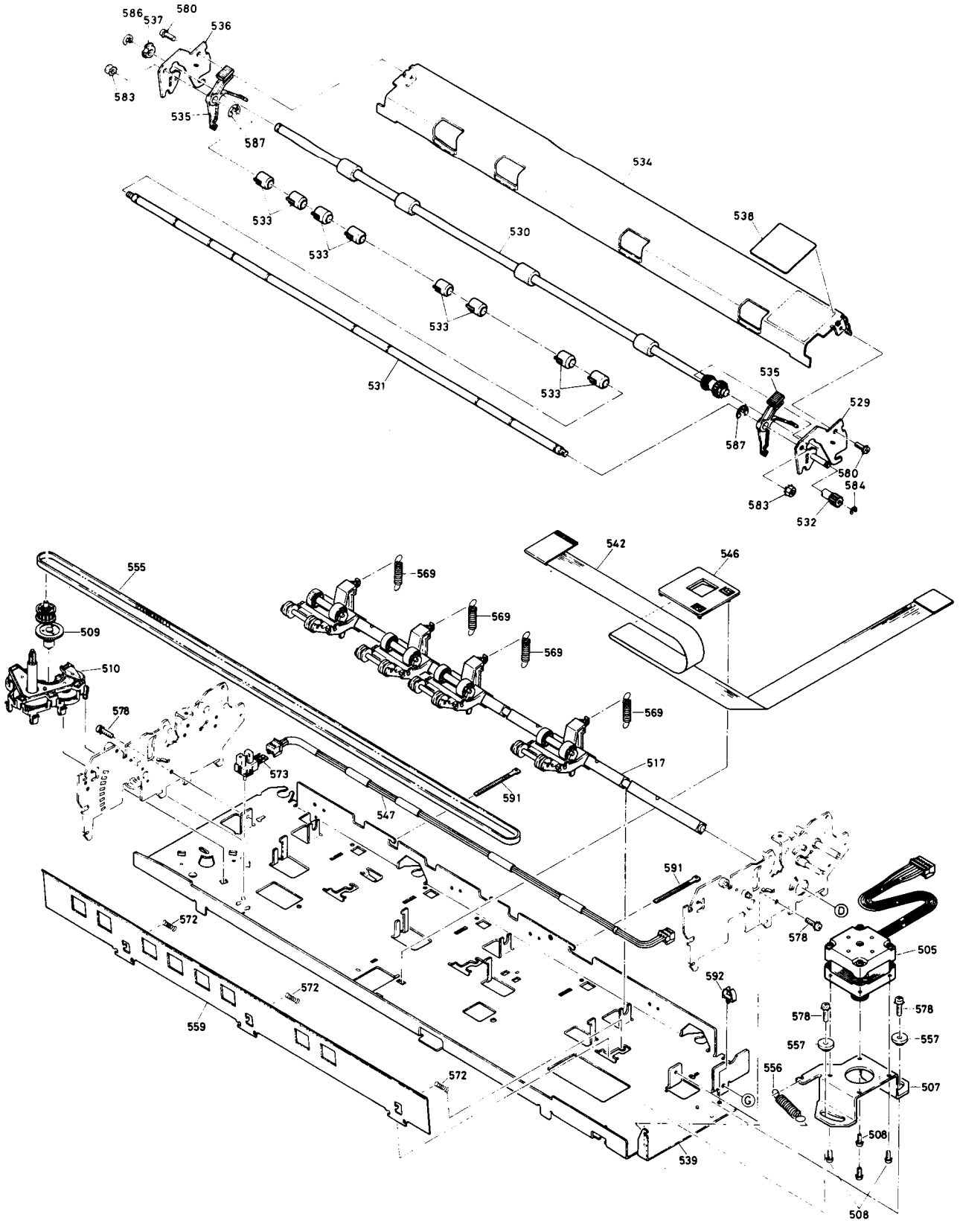


Figure A-25. FX-105O Exploded Diagram (3)

Table A-27. FX-105O Parts Name Reference

Ref No.	Description	
100	LOWER CASE	
101	PRINTER COVER A	
102	PRINTER COVER B	
103	SHEET GUIDE COVER	
104	SHEET GUIDE ASSEMBLY	
105	BASE PLATE	
106	UPPER CASE	
107	SIDE COVER	
108	LOGO PLATE	
109	GROUND PLATE	
111	PLATEN KNOB	
112	SHIELD PLATE	
115	RUBBER FOOT	
116	C.B.B. SCREW	M3×8
117	C.B.B. SCREW	M3× 10
118	C.B.B. SCREW	M4 X 12
119	C.B.B. SCREW	M4 X 12
120	C.B.B. (P) SCREW	M4 x25
121	C.P.S. (0) SCREW	M3×6
122	C.B. (0) SCREW	M4 X 8
123	C. B.S.(O) SCREW	M4 X 8
124	C.B.P. SCREW	M3×8
200	PEGX BOARD UNIT	
201	HEAT SINKER	M38 1-010
202	HEAT SINKER	M395-050
204	INSULATOR	M38 1-020
205	TRANSISTOR HOLDER	M903-108O
206	C.C.S. SCREW	M3 X 12
207	C.C.S. SCREW	M3 X 16
208	C.C.S. SCREW	M3× 10
300	PEBFIL-II BOARD UNIT	120V
301	FUSE	125V 2A
310	PEBFIL-II BOARD UNIT	220V/240V
311	FUSE	250V 1.25A
320	PEBFIL-II BOARD UNIT	100V
321	FUSE	125V 2A
350	POWER TRANSFORMER	120V
351	POWER TRANSFORMER	220V
352	POWER TRANSFORMER	240V
400	POWER CABLE	220V
401	POWER CABLE	240V
402	POWER CABLE	240V
403	POWER CABLE	240V
450	PGPNL BOARD	
500	PRINTER MECHANISM M-3B 10	
501	FRAME (LEFT)	
502	PAPER HOLDING LEVER (LEFT)	
503	FRAME (RIGHT)	
504	PAPER HOLDING LEVER (RIGHT)	
505	CARRIAGE MOTOR	
507	CARRIAGE MOTOR MOUNTING PLATE	
508	C.P.S. (0) SCREW	M3 X 6
509	BELT DRIVEN PULLEY ASSEMBLY	
510	RIBBON DRIVE ASSEMBLY	
512	FLUCTION/TRACTOR SENSOR	
513	CARRIAGE UNIT	
514	PLUNGER ASSEMBLY	
514	PAPER GUIDE UNIT	
516	PAPER END SENSOR	
517	PAPER FEED ROLLER ASSEMBLY	
518	PAPER HOLDING ROLLER ASSEMBLY	
519	TRACTOR FRAME	
520	TRACTOR SHAFT	
521	TRACTOR ASSEMBLY (LEFT)	
522	TRACTOR ASSEMBLY (RIGHT)	

Ref No.	Description	
523	PAPER SUPPORT	
524	TRACTOR GEAR	
526	TRACTOR UNIT COVER	
527	SPROCKET GUIDE SHAFT	
528	PAPER TENSION UNIT	
529	PAPER TENSION FRAME (RIGHT)	
530	PAPER TENSION ROLLER SHAFT ASSEMBLY	
531	PAPER TENSION SUPPORT ROLLER SHAFT	
532	PAPER TENSION ROLLER TRANSMISSION GEAR	
533	PAPER TENSION SUPPORT ROLLER	
534	PAPER TENSION UNIT COVER	
535	PAPER TENSION LOCK LEVER	
536	PAPER TENSION FRAME (LEFT)	
537	PRINT WHEEL SHAFT HOLDER	
538	PAPER GUIDE LABEL	
539	BASE FRAME	
540	CARRIAGE GUIDE SHAFT B	
541	HEAD ADJUSTMENT LEVER	
542	CARRIAGE GUIDE SHAFT B	
544	HEAD ADJUSTMENT BUSH	
545	PARALLEL ADJUSTMENT BUSH	
546	HEAD CABLE HOLDER	
547	HOME POSITION SENSOR CABLE	
548	DAMPER	
549	DAMPER SPACER	
550	TRANSPORT LOCKING BRACKET	
551	HEAD CABLE GUIDE	
552	OIL PAD	
533	RIBBON MASK	
555	TIMING BELT	
556	TIMING BELT TENSION SPRING	
557	CARRIAGE MOTOR MOUNTING PLATE BUSH	
558	PLATEN COVER	
559	PAPER GUIDE PLATE	
560	PAPER FEED MOTOR	
561	PLATEN SHAFT HOLDER	
562	PLATEN	
563	PLATEN GEAR	
564	PAPER FEED REDUCTION GEAR	
565	TRACTOR REDUCTION GEAR	
566	TRACTOR REDUCTION GEAR SPRING	
567	PAPER RELEASE LEVER	
568	SUB PAPER RELEASE LEVER	
569	PAPER FEED SPRING	
570	PAPER HOLDING LEVER SPRING (LEFT)	
571	PAPER HOLDING LEVER SPRING (RIGHT)	
572	PAPER GUIDE PLATE SPRING	168-410
573	HOME POSITION SENSOR	
574	CARRIAGE SHAFT A	
575	PLAIN WASHER	8 XO.5 X 15
576	LEAF SPRING	B.2 XO.2X 15
577	LEAF SPRING	8.2 XO. 15 X 15
578	C.P.S. (0) SCREW	M3× 10
580	C.P.S (0) SCREW	M3 X 8
581	C.P.S. (P) SCREW	M3× 10
582	C. B(N).S. SCREW	M3×6
583	HEXAGON NUT WITH OW	M4
584	RETAINING RING	TYPE-E(2.3)
585	RETAINING RING	TYPE-E(3)
586	RETAINING RING	TYPE-E(4)
587	RETAINING RING	TYPE-E(5)
588	PLAIN WASHER	5 XO.3 x 10
589	LEAF SPRING	6x0. 15X 11
590	SPRING PIN	2x 14
591	WIRE BAND	SKB-1 M
592	MINI CLAMP	

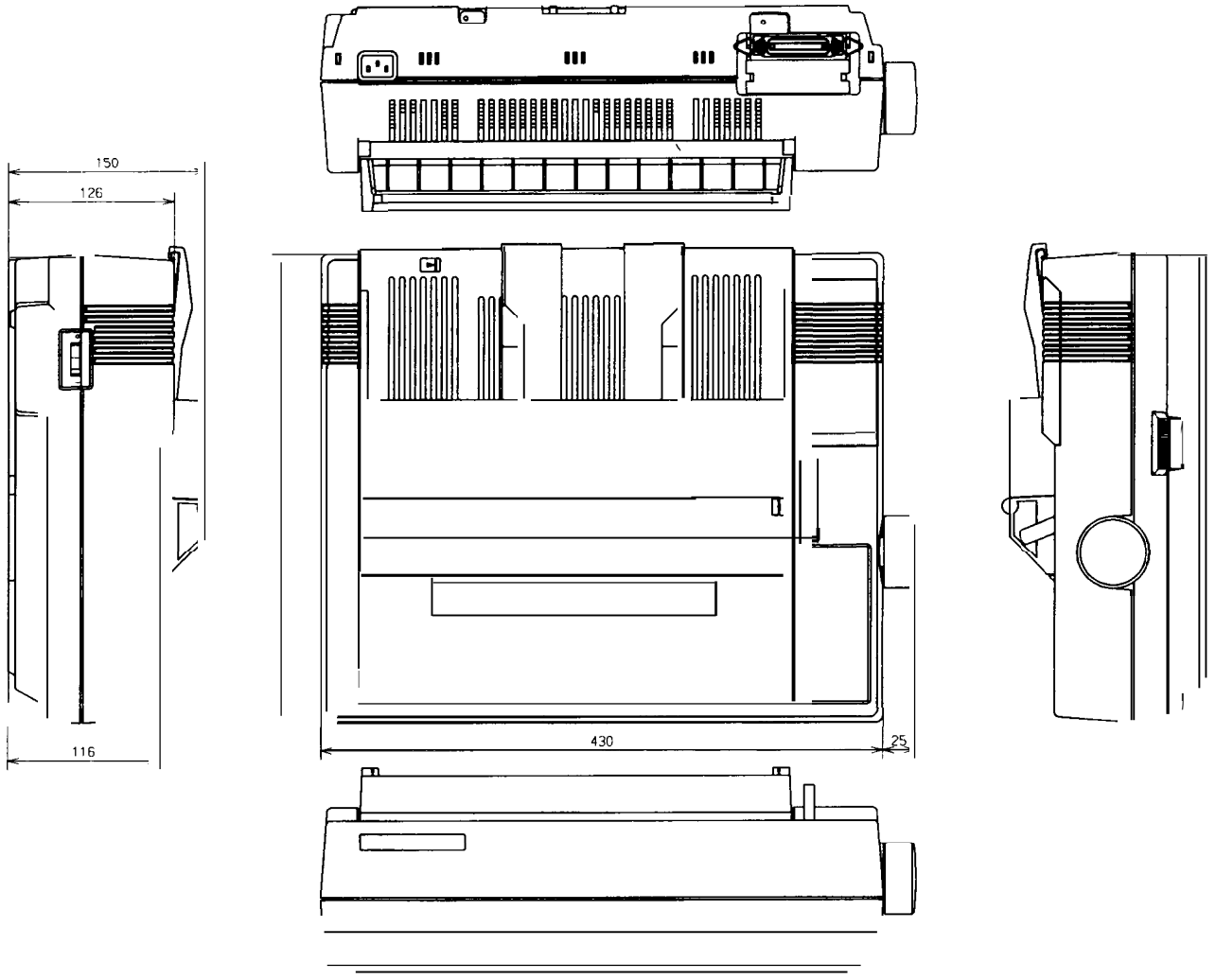


Figure A-26. FX-850 Case Outline Drawing

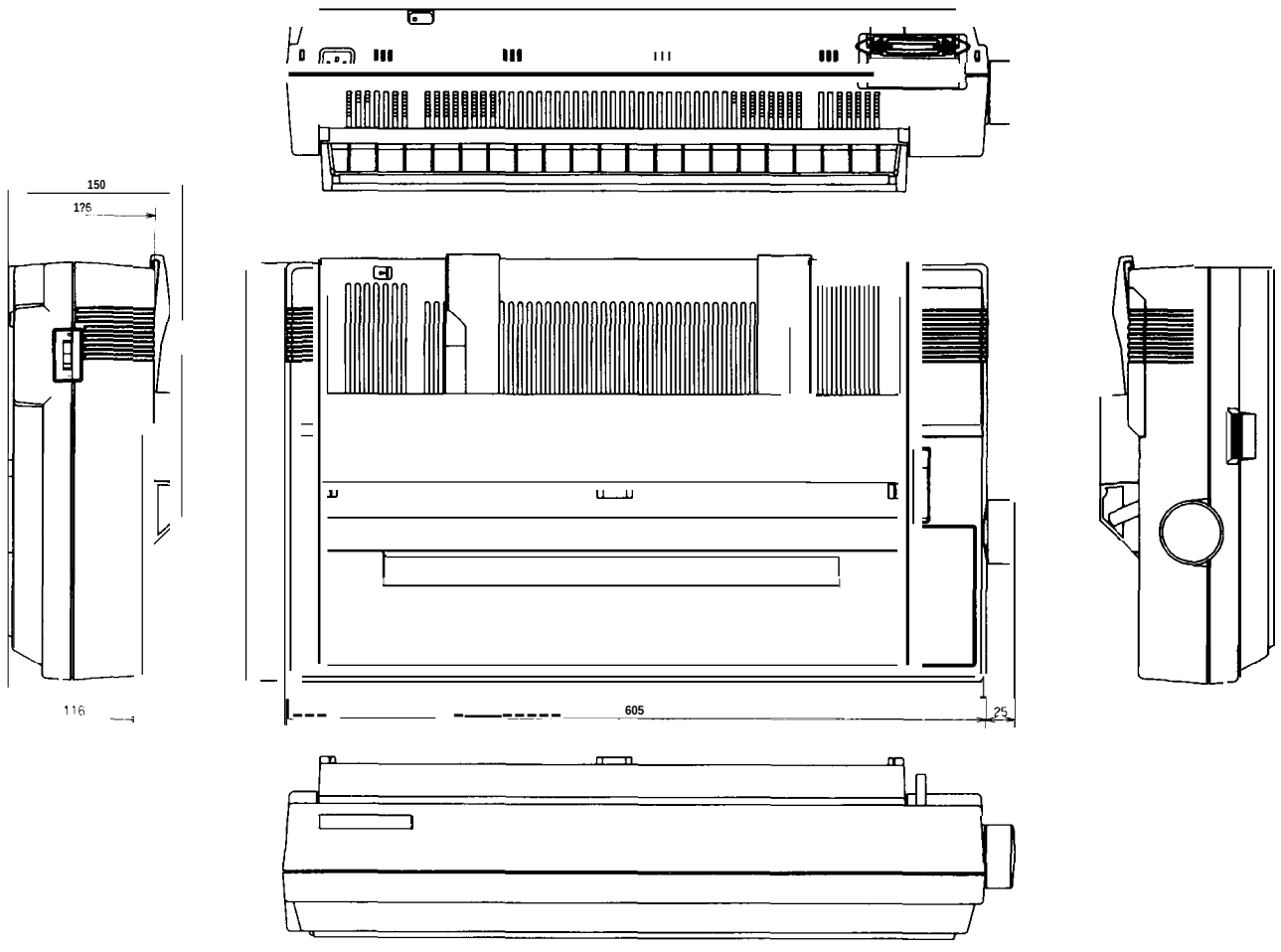


Figure A-27. FX-1 050 Case Outline Drawing

EPSON

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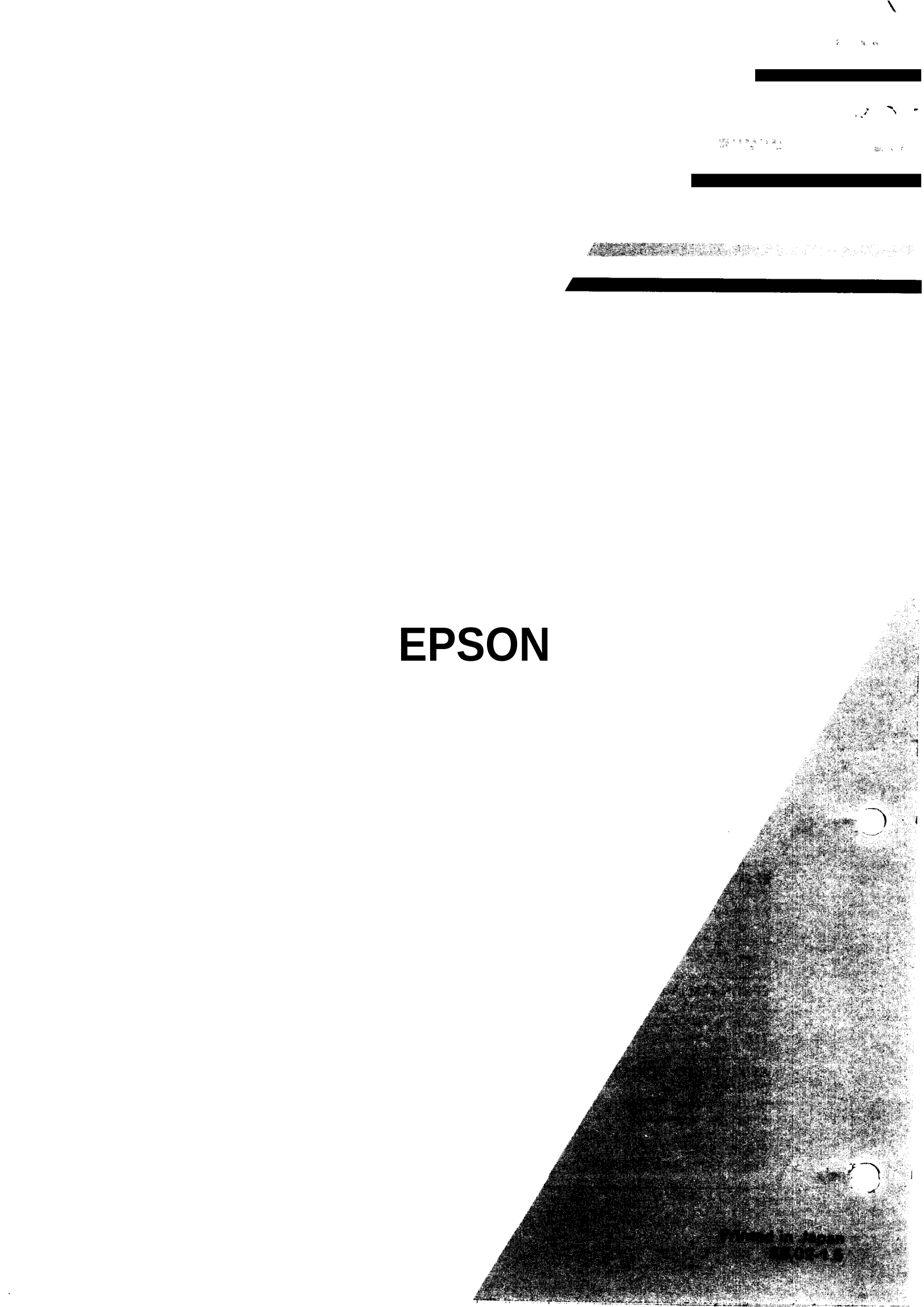
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